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RAILWAY PROBLEMS.

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RAILWAY PROBLEMS:

AN INQUIRY

INTO THE

ECONOMIC CONDITIONS OF RAILWAY WORKING IN DIFFERENT COUNTRIES.

BY

James Stephen JEANS,

FELLOW AND MEMBER OF COUNCIL OF THE STATISTICAL SOCIETY,

AUTHOR OF "ENGLAND'S SUPREMACY," ETC.

LONDON:

LONGMANS, GREEN, AND CO.

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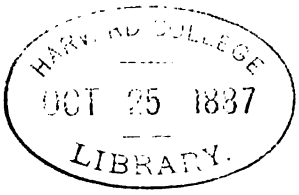

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R.A.O. 12-16-40

Inscribed

TO

DAVID DALE, OF DARLINGTON,

IN TOKEN OF

LONG FRIENDSHIP, MANY FAVOURS,

AND HIGH ESTEEM.

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INTRODUCTION AND OUTLINE.

THE purpose of the present work, as indicated in its title, is to inquire into the economic circumstances of railways in the principal countries of the world; to compare them, in their broadest and most comprehensive aspects, as regards their development, their traffic, their receipts, their working expenditure, their present financial condition, and their future prospects. This is undoubtedly a considerable, and is likely to be regarded as an ambitious, undertaking. That it is one of not a little difficulty and enormous labour the author is fully aware. That such a work, at the very best, must leave much to be desired, he is also conscious. But he is, nevertheless, hopeful that, "with all its imperfections on its head," the present volume may, to some extent, answer the everyday requirements of railway authorities, railway shareholders, railway freighters, and the general public—all of whom possess, in varying degrees, an interest in the subjects dealt with.

Intended, as it has been, for the use of a wide area of railway interests, the work is necessarily of considerable range; and this circumstance may probably be found to be at once its chief merit and its greatest defect. To have treated exhaustively any one of the many subjects dealt with would have involved a fulness of detail, a precision of analysis, and other characteristics that were impossible of attainment in one volume.

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There is no industry of any great importance that has not been more or less revolutionised by the inventive genius and capacity of Englishmen.[1] The crowning achievement, however, was the invention and the ultimate perfection of the locomotive engine. It was this that made possible the railway system; this that made England the pioneer in that vast enterprise that has done so much to bring the nations of the earth into closer contact and sympathy; this that has made every other country the infinite debtor to all time of English mechanical skill and commercial enterprise. It is not, perhaps, too much to say that the proudest page in England's annals is that which sets forth her connection with railway development.

Probably not many people have seriously and philosophically considered how much the well-being and prosperity of a nation is bound up with, and controlled by, the railway facilities at its command. Next to a prolific soil, and the possession of great natural resources otherwise, there is no adjunct of material progress that is so generally important, and exercises so vital an influence on national characteristics, as the growth of the railway system. Nay, it may even be claimed that these *desiderata*, however essential, are almost, if not altogether, subordinate in their rank to the ownership of due facilities for transport. By means of such facilities the productions of a poor soil and an ungenial climate may, with a comparatively small expenditure of time, trouble, and cost, be supplemented or superseded by those of districts more happily gifted by nature. Countries that are entirely destitute of mineral or such other resources as are usually deemed to be essential to industrial prestige may, in the same way, be brought up almost to the level of lands that teem with wealth; and so with many other attributes of well-being that will readily occur to the reader.

[1] Using the term in its broadest sense, so as to include Scotchmen also.

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Again, every member of every civilised community is practically interested in railway transport. The more civilised the community, the more directly it is concerned in, and dependent on, railway development. There are differences of opinion as to the real "hub" of the universe; but whether it be London, or Paris, or Vienna, or Berlin, or Boston, its claims to be regarded as the pivot on which laws, commerce, culture, civilisation, revolve, must be greatly affected, if not absolutely determined, by the extent and character of its facilities for rapid and ready locomotion. To the people of most cities, indeed, this has become so familiar an experience as to be as much part and parcel of everyday existence as rising up and lying down, going out and coming in. The rail has enabled modern capitals to assume proportions and characteristics that would not otherwise have been attainable.

The idea is still found associated with general ultra-Conservatism of creed, that things would have been better under the old dispensation; that employment would have been more full and regular, and contentment more widely diffused, in the absence of that intimate knowledge which the abridgment of space and time has furnished as to the conditions of living in other districts and other parts of the world; that life would have been more tolerable, relieved from the constant high pressure, excitement, and hurry to which railways have so powerfully contributed; and that, if the prices generally paid for commodities not strictly indigenous to the soil would have been higher than now, there would have been a set-off to this in the less expensive habits of life indulged in, and the more generally primitive character of existence. Such, no doubt, is a highly-pleasing picture, so far as it goes. There is always a large section of pessimists who deplore the life of the past, which their too fond imagination has gilded with the roseate hues of Arcady, and in every feature of which they recognise the silver lining that they usually

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fail to find in the new order. The fox-hunting squires, who deprecated the construction of railways because they were likely to threaten some highly-prized fox-covers; the bucolic mind, that feared the effects of a collision between a locomotive and a stray "coo;"[1] the carrying interest, that dreaded lest its occupation should be utterly gone; the æsthetic mind, that regarded railways as a terrible disfigurement to the landscape; the nervous and hypochondriacal mind, that was liable to take a gloomy view of the effects of railway travelling upon the constitution of man; the commercial monopolist, who feared that his cherished monopoly would disappear under the influence of the universal leveller,—all these, and many other early types, have been reproduced in our own day, with much less show of reason than their originals. But as in the earlier, so in the later examples of the *genus* obstructionist —events have not justified their apprehensions, but, on the contrary, have signally falsified them in almost every particular.

There are many aspects under which the railway may be regarded as the pioneer, the handmaiden, and the finisher of commerce. It has become recognised in all civilised communities as an essential adjunct of progress. In a country which, like our own, is so exclusively dependent upon the importation of many articles required in manufacturing industries, in works of construction, in the sustentation of life itself, the functions performed by the railway are of the most important character. Take, as an example, the single item of cotton. We now import into this country nearly 800,000 tons of raw cotton per annum. This large traffic is conveyed to the mills in Lancashire, in Yorkshire, in Lanarkshire, and wherever

[1] One of the best-known stories of Stephenson is that, when he was under examination before a Parliamentary Committee, the question was asked whether, if a locomotive came into contact with a cow straying on the line, it would not be very awkward. "Yee," was the reply, "very awkward for the coo!"

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else they may be situate, at a *minimum* of cost, and with a regularity and facility that ensures entire absence of apprehension on the ground of supplies. It is the same with the imports of all other products required in our great industries, and with the very considerable traffic in such raw materials as we export in the way of exchange. The railways of this country alone move upwards of 170 millions of tons of minerals annually. It is impossible to say precisely what is the average distance over which this immense product is transported. It may be twenty miles, and it may be thirty. But if it is taken at only twenty miles, we should find that our railways carry nearly 4000 millions of tons of minerals one mile in the course of a single year. It is difficult to conceive of this traffic being carried by the old pack-horse. It might, of course, have been transported by canal navigation; but even the latter resource is a comparatively new one, since there were very few canals available before the middle of the last century. The phenomena which are presented for consideration by the railway traffic of the United Kingdom are, however, eclipsed in point of magnitude by those of the United States, where from 45,000 millions to 50,000 millions of tons of traffic are now annually moved one mile. The most lively imagination finds it difficult to grasp such portentous figures. Equally, or still more, difficult is it to imagine the carrying on of such a huge traffic without the aid of railway resources.

Among the leading countries of the world, there is none that affords such a large traffic to the railways, relatively to the population, as that of the United Kingdom. The average number of passengers carried by the railways of England and Wales is 22.8 per inhabitant. The next highest record in Europe is that of 11 passengers per inhabitant in the case of Belgium, but our Australian Colonies show an average of 18.6 passengers for every head of the population. In Germany the average number of

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railway travellers per head of the population is only 5·3, while Austria, Spain, Italy, Sweden, and Norway each have from 1 to 2 passengers per head. France runs very much on all fours with Germany; and the United States of North America are ahead of either, with 6 passengers *per capita*. Among countries that have less than 1 passenger per head we find Roumania, Portugal, Finland, Russia, Japan, Egypt, and our Indian Empire.

It is further to be remarked, that while the annual ratio of railway travellers to population is 22.8 in the case of England and Wales, and 13.6 in Scotland, it falls to 3.8 in Ireland, which country shows precisely the same ratio as Denmark.

There can be little doubt that one of the best tests of the commercial importance of a country, both absolutely and relatively, is that of the extent of its railway traffic, and this applies equally to goods and passengers. A country that shows a large tonnage of merchandise moved per head of the population is almost certain to be in a better position, relatively to wealth and general prosperity, than a country in which the movement of merchandise is small. Examined from this point of view, it is important to find that there is a much greater tonnage moved on British railways than on those of any other country except Luxembourg, the next in order of importance being—

United States	7.6	tons per	inhabitant.
Belgium	6.5	„	„
Germany	4·3	„	„
Canada	3.1	„	„
Australia	3.0	„	„
France	2.5	„	„
United Kingdom . . .	7.5	„	„
England and Wales . . .	8.4	„	„

The average for the United Kingdom would, of course, be considerably higher were it not that Ireland is so

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low in the scale. In the latter country the tonnage moved per inhabitant is only 0.8 ton, while in Scotland the average rises to 9.5 tons. In other words, Scotland has more than ten times the quantity of railway goods traffic per inhabitant that is shown for Ireland. This remarkable difference, it need hardly be pointed out, is fully reflected in the returns of all the other *criteria* of national prosperity, such as those of income-tax, &c. Bad, however, as Ireland is in this comparison, there are several important countries whose circumstances are still worse, such as Italy, with only 0.4; Spain, with only 0.6; Russia, with 0.5; and Roumania, with 0.3 tons per inhabitant. Japan has exactly the same ratio of tonnage to population as Ireland, and British India has a fraction under Japan.

These figures open up a wide field for speculation. What is the *per capita* standard of average transportation requirements? Is it the 8.4 tons found for England and Wales, the 7.6 tons found for the United States, the 4.3 tons found for Germany, or the 2.5 tons found for France? We have elsewhere shown that the total volume of traffic carried on the railways of Europe and the United States, collectively, is rather over a thousand millions of tons. If we divide into this sum the population of the same countries, the average traffic carried per inhabitant comes out as three tons. If, however, the average of the United Kingdom is to be adopted as the ultimate standard, we should find that the present annual traffic of about a thousand millions of tons will require to be raised to 2525 millions of tons—a figure which is certainly not beyond the limits of possible attainment, although it may not be readily attained.[1]

[1] The tendency in all countries has been to increase the volume of goods traffic carried, relatively to population. Thus, in 1872, the railways of the United Kingdom only carried 5.6 tons per head of the population. In 1882, this figure had advanced to 7.6 tons *per capita*. Since 1882 there has been a falling off, and in 1885 the average had fallen to 7.0 tons, but in the interval trade had been exceptionally depressed.

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Mutatis mutandis, passenger traffic tells the same tale. There is no reason to believe that the present relation of railway travellers to population will be stationary. On the contrary, all experience and analogy justify the expectation that it will greatly and rapidly increase. Why should not the standard of 22.8 travellers *per capita*, found for England and Wales, become the average of the European Continent? Nay, more, why should it not become the average of the civilised world? The English people, it may be said, are the most restless and migratory in their habits of any nation now extant; but they are so only because their paramount place, in regard to commerce, industry, and all the attributes of an advanced civilisation, has produced, if it has not been created by, that special development of character. Other nations, which are seeking to rival us in whatever matters we have attained conspicuous success, must emulate also the habits and the methods whereby that success has been attained. Facility of intercommunication is one of the most essential and indispensable of such methods; and those who care to pursue this interesting subject further will find that the growth of England's commercial prosperity has been coincident with the extension of those facilities, and their increased adoption by all classes of the community.[1] From this point of view, then, it is a matter of vital concern to the railway interest to know that if the number of railway travellers per head of the population were the same in Continental countries as in England and Wales the present average of less than three would be raised to over twenty-two *per capita*, and the total annual number of such travellers would be raised from under 700 millions to 5456 millions.

In a rough-and-ready sort of fashion, these figures

[1] Even in the United Kingdon, where there had already been an exceptional development of passenger traffic, the total number of travellers by railway increased from 422¾ millions in 1872 to 697¼ millions in 1885, being an increase from 13.3 to 19.2 travellers *per capita*.

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illustrate both the present condition and the possible future of the railway interest. That interest is even now one of the vastest extent and influence. Alike in respect of the expenditure that it has entailed, the profits that it yields, the numbers to whom it furnishes remunerative employment, the influence that it exercises upon the destinies of individuals, localities, and nations, and the part that it is likely to play in the future of the world's economy, there is, perhaps, no other single factor of human prosperity and progress that will not kick the beam when put in competition with it.

By way of emphasizing these reflections, we may point out that there is, perhaps, no direction in which the railway system has exercised so potent an influence as in that of bringing modern nations into more harmony in matters of social concern. The fact is not, perhaps, so generally understood as it should be, that railways are the great levellers of the world. Their tendency is always in the same direction—to level up the rate of wages or the cost of labour, and to level down the cost of the necessaries of life; and it is obvious that such a tendency can only be attended with general benefit to the human race.

This abstract proposition may be enunciated and supported by a concrete instance. If it were attempted to compare the prices of provisions and the rates of wages now paid in, say, Asia Minor, where there are very limited railway facilities, it would be found that they were entirely different to those of any country differently situated in reference to the possession of such facilities. Food is scarce and dear if there is a poor soil and a large population, because the population, pressing on the means of subsistence at hand, is not in a position to have its inadequate home supplies supplemented by foreign importations. If that were possible, the cost of home supplies would practically be reduced to the level of the cheapest foreign-grown supplies, *plus* the cost of bringing the commodity to the doors of the consumers—except, of

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course, in cases where that cost is artificially enhanced, as in many cases it is, by protective duties. On the other hand, a district that has superabundant, and consequently exceptionally cheap, supplies of any commodity that is in request, and of which there either exists, or is a liability to, scarcity elsewhere, is by the same process enabled to realise more or less for its products according as the distance, and consequently the cost of railway or ocean transport, to the consuming centre is great or small. It is this factor that has within a comparatively few years revolutionised the ancient economy of things throughout the world. The railway has been the potent factor in enabling the Western farmers of America to get rich in the supplying of their productions to the more populous countries of Europe. It has enabled the Indian ryot who is within access of transportation facilities to get double the prices for his crops that are available to his brother ryot in a remoter district. It has furnished the Russian peasant with a direct and important interest in the demands and requirements of Western Europe. It has compelled the British farmer to largely discontinue the growth of cereals, and has brought the agricultural interest of our own country to the verge of bankruptcy.

It is within the powers of railway boards to exalt one district and depress another at will. The prosperity of a district is not now, as formerly, to be measured by the equability of its climate, the fertility of its soil, and the laborious industry of its people, so much as by the high or low rates under which the railways by whom it is served allow it to reach the markets of the world. The same remarkable power can, and often does, stimulate the growth of industries in localities that are not naturally suited for their development, and tends to the destruction of once-flourishing industries in localities which it fails to favour.

As an adjunct of modern warfare, railways have brought about remarkable and beneficent changes. In olden times, campaigns were fought out for more than as many years

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as they now occupy months, or even weeks. It is scarcely possible to conceive of a thirty years' war under the order of things established by the locomotive. Nor would our own costly experiences in the Peninsula have been half so costly if the massing of troops on a large scale, and with the utmost celerity, had been accomplished as readily as it may be now. The Franco-German War would probably have extended over a much longer time if the railway had not aided in abridging its duration. And it is not only in respect of moving the fighting *matériel* that the railway has done signal service, but it has been scarcely less efficacious in enabling the commissariat to be kept up at a high point of efficiency not otherwise attainable. In the olden days, a large army could only be provisioned from its immediate neighbourhood. Now, it may receive its supplies from an area of indefinite extent, and with infinitely greater regularity than before.

Once more, there is no single instrument, influence, or agency that has done more to span the gulf that divides the modern from the ancient world than the locomotive engine. How few people think of the potency of the system that has so powerfully contributed to mark and emphasize this distinction! If we analyse the comparative circumstances of ancient Rome and modern London, —of ancient Babylon and modern Babylon,—what single characteristic can we point to as "toeing the line" of division so marked, so palpable, so essential, as that of the railway? The dimensions of ancient Rome were necessarily limited by reason of the physical difficulties of movement inherent to a state of things from which steam was absent. Its area, which has been calculated as not more than 3260 acres in its most palmy days, was not one twenty-third of that of London.[1] Its population never exceeded a million inhabitants, according to the best authorities. The obstacles in the way of getting from place to place induced the people to carry their houses to a great height,

[1] The total area of the metropolis is now 75,000 acres.

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in order that the population might be accommodated as far as possible within the walls of Aurelian, which were calculated at about twelve miles in circuit, or about the same as the outer boulevards of Paris; and so far was this carried, that the Emperor Augustus was led to decree that no houses should be built to a greater height than seventy feet. In modern London, on the contrary, we have suburbs, extending over many square miles of area, within which the movement of population may be carried on with much greater facility than was possible in the infinitely more circumscribed area of the "mistress of the world." In Rome, the dwellings of the poor people were crowded for the most part about the principal seats of traffic—the Velabrum, on the one side of the Forum, and the Suburra on the other. In modern London, this is also to a large extent the case, as the regions of Seven Dials and the New Cut sufficiently testify; but it is not now, as then, unavoidable; and many thousands of the respectable poor work in the city by day and enjoy some measure of quiet and comfort in pleasant suburbs by night. But for the facilities and amenities introduced by the locomotive and the rail, modern London would scarcely be possible as we know it; and if it had been possible with regard to dimensions, there must needs have been an enormously greater expenditure of time occupied in moving from the suburbs to the centre which the railway system has enabled us to save.

It is difficult to estimate the full economic value of this great change. If, however, we assume that only 500,000,[1] or about one-tenth of the population of greater

[1] This does not appear an exaggerated estimate, when we consider that in 1885 the Metropolitan and Metropolitan District Railways carried 118 millions of passengers (allowing 300 journeys to each season-ticket holder), being an average of 390,000 passengers per day for 300 working days. The North London Railway carried a further 59 millions (allowing an average of only 100 journeys to each season-ticket holder), or about 197,000 per working day. If the traffic of the other railways is added, the average number of passengers is likely to be nearer 1,000,000 than 500,000 per day.

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London, require to travel every day to and from business, &c., and that each is enabled, by the superior speed of the rail, to economise about two hours per week, we should find that there would be an average saving of about five days per annum; or, in other words, there would be a total economy of about 8300 working years of three hundred days each, which, assuming an average income of £100 per head, would represent a total annual economy, reduced to terms of average earnings, of about £830,000. These figures do not, of course, pretend to accuracy, but they may sufficiently illustrate the general scope of the facts and argument.[1]

There is no class of property that has, within recent years, more largely increased in value than that of railways. Between 1870 and 1884, the net profits from railway working in the United Kingdom rose from 23¼ millions to 33¼ millions—an increase of 10 millions, or about 43 per cent. In the same interval the annual value of house property in the United Kingdom as a whole increased from 81½ millions to 127 millions—an increase of about 46 millions, or 58 per cent.; that of land from 64 to 65½ millions; that of mines from 5½ to 7 millions; that of ironworks from 2 to 3 millions; that of gasworks from 2⅛ to 4⅛ millions; and that of quarries from 7 to 9 millions. But it is observable, in respect to the net profits from railway working, that they have not fluctuated from year to year in the same way as nearly all other profits have done. Thus, for example, agricultural profits are now very much below what they were a few years ago. It is the same with house property, mining property, and manufacturing investments generally. If we were to assume that the rental of the land of the United Kingdom had within the last few years been reduced, on an average, by only 5s. per acre—

[1] There is, of course, a very numerous body who still make use of slower methods of locomotion, as tram-cars, river steamers, and omnibuses; but the railway is generally at their command, even if they do not use it.

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although the average fall of rent will have been more than that, and not unlikely quite as much again—we should find that the annual income of the landowners of this country has been reduced by 12½ millions sterling. A still greater fall has occurred in respect of the income of those who cultivate the soil. On this subject the income-tax returns do not tell a perfectly true tale. These show that the full annual value of the land of this country was 58 millions sterling in 1870, and 65½ millions in 1884, showing an increase of 7½ millions; and as the profits from the occupation of farm lands are deemed by law to be equal, in England and Wales to one-half, and in Scotland and Ireland to one-third, of their full annual value, it would appear as if the farmer's profits amounted to 27 millions in 1870, and about 30 millions in 1884. This showing, as every agriculturist knows, is entirely at variance with the actual facts, which (considering that the price of wheat had in the interval fallen by about 12s. per quarter, of barley by 5s., and of oats by about 3s.) would seem to point to a depreciation of profits approaching 20s. per cent. on the whole. Ironworks and mines have been in much the same category as lands and farmers' profits. It is perfectly true that the total value of the minerals produced in the United Kingdom is officially returned as having been about 46 millions in 1870 and 64 millions in 1884, or an increase of about 18 millions; but this is not the best test of healthy growth, seeing that in the latter year a great deal of our mineral produce was raised without anything like adequate profit,[1] and it is morally certain that in the interval some millions were embarked in mining

[1] In 1870, the annual profits from British mining assessed to income-tax were returned at £5,544,000, being an average of 10d. per ton raised, or 2.4s. per £1 of official realised value. In 1870, the assessable profits were £7,065,000, being an average of 9d. per ton raised, or 2.2s. per £1 of official realised value. In the interval, however, both the average value and the average realised profits on mineral produce had fallen to a much greater extent than these figures indicate.

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enterprise upon which not one penny of profit has ever been realised.

It comes, then, to this, that, next after land and house property, the railway interest is the largest and most important in the country. But it is superior to both of these rival interests in its profit-earning capabilities, yielding, as it does, more than 4 per cent. on the capital expended, against a possible average of 2½ to 3 per cent. in respect of the others. The agricultural value of the land of the United Kingdom has been variously calculated. If it is assumed at an average of 20s. per acre, *at the present time*, it would be worth, at twenty years' purchase, a gross sum of 1000 millions sterling, being an average of about £26, 10s. per head of the population.[1] But the railways of the United Kingdom are now nearly worth the same figure. At the end of 1885, about 820 millions had been raised and invested in our railway system, being within 180 millions of the calculated total agricultural value of the land of the country as a whole, and averaging more than £22 per head of the population.

Probably enough has now been said to convey an idea of what the railway interest is, what it has accomplished, and what are the prospects that lie before it. It still remains for us to speak of it in its administrative aspects, with which it is the special purpose of the present work to deal.

The railways of the United Kingdom have, in some respects, acquired an enviable distinction. Nowhere else in the world is travelling attended with such a high degree of safety. In the period of thirty-six years from 1847 to 1883, 665 persons were killed by accidents to trains from causes beyond their own control. During the same interval, 9263 millions of passengers travelled on the

[1] In this calculation, the land available for agricultural purposes has been taken at 50 millions of acres. The very considerable area which is not so available has, therefore, been disregarded.

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railways of the United Kingdom. Hence, only one in every fourteen millions who travelled was killed; and if the seventy-three persons who lost their lives in the Tay Bridge disaster are excluded, the loss of life from this source would be reduced to one in every 15¾ millions who made use of the railway. There has been a steady improvement within recent years. In 1878–81, one passenger was killed in every 15½ millions; in 1882, the proportion was reduced to one in 36½ millions; and in 1883 it was still further reduced to one in every 62¼ millions. These figures compare favourably with those for Continental countries. Belgium, which has, as regards her railway system, more in common with England than any other country—the traffic being almost equally great relatively to mileage, the speed tolerably high, and the trains numerous—shows for the forty-nine years ending 1884 an average of one passenger killed for every six millions carried, being more than double the ratio found for Great Britain.[1]

The high rate of speed adopted on British railways, the great number of express trains, the consequent facilities provided for rapid and frequent transit, the superior terminal resources, which tend to the safe and speedy despatch of traffic, and the unexceptionable condition of the permanent way—all these leave little or nothing to be desired. But the advantages so conferred on English traders and travellers have been purchased at a high price. The enormous capital embarked in British railways has induced the adoption, and, perhaps, the unavoidable maintenance, of high tariffs. This is the most serious defect of British railway administration. It is doubtful whether it can be remedied without a radical change of the whole system; and it is equally doubtful whether any consideration short of stern necessity would

[1] The conditions of the comparison are not, however, strictly parallel. The Belgian returns do not, like the British, distinguish between passengers who were killed from causes beyond their own control, and those who were not.

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induce the average Englishman to purchase reduced rates and fares by a slower rate of speed, by a much more limited service of trains, by delay in delivery of goods, and by less perfect terminal facilities. The railway companies are not unnaturally prone to set up the superiority of their service as an answer to the demand for Continental or American rates of freight, and it would appear as if the two could not successfully co-exist. There are, however, many features of the English system that may be modified with advantage. The working charges are generally heavy, the average loads might be very considerably increased, first-class passenger traffic should be made as profitable as third-class, the heavier traffic should be transferred to canals from lines where the gradients and curves are very difficult, the mode and principle of levying rates should be placed on a more certain and readily intelligible basis. The existing methods have too much of a catchpenny look to befit such an enormous and dominating interest as that of the railway system. The "terminal" question has been shown to be in an extremely unsatisfactory condition. As the case stands at present, the charges for so-called terminal services are imposed in a capricious and arbitrary manner. Equally unintelligible and destitute of method is the classification, which ought, as proposed by Lord Henniker's Committee, to be dealt with by Parliament.

The historical, the social, and the local and national features of the railway system have been dealt with in many different works of more or less fulness and merit. The present is, however, the first work that has aimed at an examination of the economic conditions of railway working throughout the world. The novelty of the enterprise, the vast field to be covered, the enormous mass of figures to be dealt with, the dissimilar circumstances that have often had to be compared, and the difficulty of observing a due proportion in the degree of importance assigned to each several aspect of the subject, have all tended to sur-

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round the author's labours with dangers and pitfalls of no ordinary kind. Nevertheless, he ventures to hope that, in spite of inevitable defects, the work may prove a useful contribution to the solution of some of the great and intricate problems that are involved in the business of transportation, as carried on in different countries.

The scope and character of the undertaking has of necessity compelled the very liberal employment of statistics. Many of the problems dealt with could, indeed, only be treated by the numerical method. On the general public this circumstance is likely to produce a repellent effect. To those for whose use and benefit the book has chiefly been written, the statistical data afforded will prove its chief value. From first to last there are about two hundred tables in the volume, scarcely one of which has ever before been published as it now appears.

In England, we appear to be on the eve of important changes in the relations of the railways and the public. Those relations are at present hardly satisfactory. The railway companies themselves are ready to admit the fact. On the part of some of the more moderate and intelligent railway directors, there is a disposition to co-operate with the Government of the day in placing the vexed questions of classification, terminal charges, and *maximum* rates on a more just and systematic basis. Others, however, appear disposed to resist any change *à outrance*. If the statistical matter contained in the present work should aid in the settlement of the impending controversy, it will have have done some service. The author can, at any rate, claim that he has endeavoured to write without conscious intention to "extenuate or set down aught in malice;" and while he has often had occasion to animadvert on defects in English railway administration, he has also found some things to commend.

The greater cost of transport in the United Kingdom is a factor in the industrial situation that cannot be either

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denied or ignored. Ten years ago a distinguished French economist estimated the mean goods tariff on British railways at 21 per cent. higher than that of the French lines,[1] and since then the difference appears to have become still more adverse to England. It may be that the special merits of English railway administration cannot coexist with the cheaper transport that is characteristic of other countries. If this should prove to be the case, it will be so much the worse for England; but the competition of European nations for industrial supremacy is now so keen, so active, and so threatening, that if England is denied the advantages of lower transportation charges, her future is likely to be beset with the gravest peril. The danger does not, however, seem to be incapable of remedy. The means whereby other nations, and especially the United States, have secured the inestimable advantages of cheap transport have been pretty fully indicated in the course of the present work; and if it should be necessary to "Americanise our institutions," in order that we may Americanise our rates and fares, the public may have to sacrifice facilities for freights.

The United Kingdom is not the only country that is at present exercised by transportation problems. The United States Government has recently had under serious consideration several measures that are designed to impose a general control over the huge transportation system of that country, in reference to the conditions under which inter-State railway traffic should be regulated, the legalisation of "pooling" agreements, the limitations to be imposed upon railway rates and fares, and other questions that have long been engaging attention more or less in Europe.

Several European countries, including France and Italy, have likewise had under recent consideration the best system of railway control. In some cases there is a disposition to increased, and in others to diminished,

[1] M. de Franqueville in "*Du Régime de Travaux Publics en Angleterre.*"

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interference by the State. It is hardly likely that the last word has been said on this subject in any country, and certainly not in England. For this reason, a chapter has been written on the purchase and administration of railways by the State. Much more might have been said on so large a question, but this is equally true of every other question that has been considered, and in order to bring the work within reasonable dimensions and cost, it has been necessary to impose definite limitations as to space.

Three of the chapters (XXII., XXIII., and XXXI.) have been read as papers at the Colonial and Indian Exhibition, and before the British Association for the Advancement of Science, and the Statistical Society, respectively. All of them, however, now appear *in extenso* for the first time. The circumstances under which these chapters are published have involved a slight, but almost unavoidable, duplication of important facts; but as the facts have for the most part been placed in new relations, their repetition may probably not seriously impair the symmetry and order which the author has striven to preserve.

It remains for the author to acknowledge the great aid that he has received from different sources in the preparation of this work. The managers of the several English railways have very courteously furnished all the information that was sought for, and have thereby greatly facilitated the author's labours. Among the books that have been referred to, special mention should be made of that valuable work, "*Statistique des chemins de fer de l'Europe*,"[1] without which whatever measure of uniformity and completeness may belong to the present undertaking would have been all but impossible.

[1] This work is issued by an international Statistical Commission composed of leading railway and statistical authorities in every country in Continental Europe.

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RAILWAY PROBLEMS.

CHAPTER I.

HISTORICAL AND RETROSPECTIVE.

THE time when the first passenger was drawn, and the first ton of merchandise was conveyed, by the first locomotive engine used on a public railroad is within the memory of living men. To many who are still alive the ante-railway era is a matter of recollection and experience. It is little more than the "allotted span" since there was but one stage-coach between London and Edinburgh, which started once a month from each place, and took a fortnight to complete the journey. In those days the charge for wagon hire from Leeds to London was at the rate of £13 a ton. For the transport of goods from Liverpool to Manchester the charge was 40s. a ton. So recently as 1825 evidence was laid before Parliament that the cotton which was transported three thousand miles across the Atlantic in twenty days occupied six weeks in its course from Liverpool to the mills of the Manchester spinners —a distance of little over thirty miles. The great bulk of the carrying trade was then in the hands of common carriers, who did their work so slowly that Sir Henry Parnell relates that the ordinary carrier between Edinburgh and Selkirk, a distance of thirty-eight miles, required a fortnight for his journey.

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In this condition of things, the attention of merchants and manufacturers was directed to the employment of canals as a means of inland transport for heavy merchandise. The canal era may be said to have been inaugurated about 1761, when the Duke of Bridgewater presented a petition for a bill to enable him to construct the canal that has since borne his name.[1] The Bridgewater Canal was commenced in 1767, and completed in 1772. It turned out a great commercial success. Many similar undertakings were, accordingly, soon afterwards projected. There was for a long period a fierce conflict of vested interests and prejudices. Dr. Johnson complained that canals would interfere with country seclusion, and make living dear where it used to be cheap, by taking rural produce to crowded centres. It was also complained that they would displace the pack-horses and wagons, which had up to that time served for cross-country transport, and that they would injure the trade of towns near which they might be carried.

These, with other objections equally short-sighted, and, in the light of our present experience, equally ridiculous, were instrumental for a time in checking canal development. But the ultimate victory lay with the canal promoters. The economy of transport effected by canals was an unanswerable argument in their favour. They are said to have reduced the average cost of inland transport to about one-fourth of the rates previously paid. Baines gives some specific examples.[2] The land-carriage from Liverpool to Wolverhampton was £5 a ton; the canal reduced it to 25s. The cost of carrying a ton of goods from Liverpool to Etruria, the centre of the Staffordshire potteries, was 50s.; the canal reduced it to 13s. 4d. The

[1] The Bridgewater Canal was strenuously opposed by landowners, by Warrington traders, interested in the navigation between that town and Manchester, and by traders and others in Manchester who were of opinion that the Mersey and Irwell navigation was sufficient to undertake all the carriage required.

[2] "History of the Commerce and Town of Liverpool."

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land-carriage from Liverpool to Birmingham, and to Stourport, was £5 a ton; the canal reduced both to 30s. The advantages of these remarkable differences were ultimately appreciated, especially by the agricultural interest, who could now have wheat conveyed 100 miles for 5s. per quarter, where they formerly had to pay 20s.

The cheaper and quicker transit of raw materials, of manufactured goods, and of agricultural produce, stimulated industry, increased population, and created wealth; and, to quote the words of a recent writer,[1] "Parliament, by its furtherance of legislation for the development of canals and of agriculture, probably contributed more largely to the national prosperity than by any other group of public or private measures passed towards the close of the last century."

Over a hundred canal Acts were passed before 1800. There was, indeed, in 1791–94 a canal-building mania, like that which in 1844–46 formed so prominent an episode in railway construction, so that eighty-one canal and navigation Acts were passed in those four years alone.

Such was the state of the ways of communication in this country at the close of the last century. England was far behind the rest of Europe in this regard. Holland had long been in possession of a well-developed system of waterways, and, according to Smiles,[2] France, Germany, and even Russia, had opened up important lines of inland communication before England had made any real progress in this direction. But England was about to make full atonement for her previously laggard pace, and to set an example to the rest of the world that has been more fruitful of material benefits to mankind than almost any other that can be named.

The first railway bill, pure and simple, was that for the construction of a railway from Wandsworth to Croydon in 1801. Two years later, another railway was sanctioned

[1] "A History of Private Bill Legislation," by F. Clifford, vol. i. p. 41.
[2] "Lives of the Engineers," Preface, p. 7.

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from Croydon to Reigate, with a branch from Merthum to Godstone Queen. Both companies met with difficulties, and came to Parliament in 1806 for fresh powers to complete their respective schemes.[1] In 1804 a railway was sanctioned from Swansea to Oystermouth. Several other lines were sanctioned before 1821, when the first Act was passed for the construction of a railway between Stockton and Darlington.

There is nothing in the records of material progress that appears to present a more interesting and happy conjunction of means to a great end than the almost simultaneous advent of the railway and the locomotive. The two were not, however, quite concurrent in their origin. The locomotive appears to have had the start. Symington succeeded in applying the principle of steam locomotion to a vessel which was employed to draw barges along the Forth and Clyde Canal in 1785. Trevithick's engine, which was tried on a railway in Wales about 1804, but abandoned on account of mechanical defects, was three years later than the first public railway—the Wandsworth and Croydon, already referred to.

Blenkinsop's locomotive, which worked by a rack or toothed rail, was in operation at the Middleton Colliery, near Leeds, in 1812; and Chapman's engine, worked by an endless chain, was placed on the Heaton Colliery Railway in 1813. Hedley's engine was working on the Wylam Railway about the same time.[2] In 1814 the first locomotive that propelled itself by the adhesion of wheels on round-top rails was tried at Killingworth Colliery, by George Stephenson and Nicholas Wood.

The locomotive engine was, therefore, an accomplished fact, and ready to the hand of the railway engineer, for some considerable time before its services were called into requisition for ordinary railway traffic. It is curious, in

[1] Clifford's "History of Private Bill Legislation."

[2] This engine is now shown in the Patent Office Museum, South Kensington, as "the oldest engine in existence."

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view of this fact, that in none of the railway Acts passed prior to 1823 was there any reference to the use of locomotive power. The Wandsworth and Croydon and other tramway Acts passed previous to 1821 were all designed to provide for the conveyance of goods and passengers by horse-power only. So, also, was it with the first Stockton and Darlington Act in that year. The success of Stephenson's locomotive led the promoters of the last-named line to apply, in 1823, for power to employ steam-engines; but this proposal was put forward, apparently, with some doubt as to the result.

The first Act authorising the conveyance of passengers on a public railway by the use of locomotives was passed in 1823. But no one dreamt, at that time, that this source of traffic was likely to become one of great importance. The first public railway Acts were concerned mainly with goods and mineral traffic, and even when passenger traffic was authorised, the company were not required to provide passenger carriages, but limited their business to charging a maximum mileage rate of sixpence upon such vehicles as made use of their line. This, however, was not, and could scarcely be, an arrangement of long duration. The inevitable introduction of railway passenger vehicles was not long deferred.

In the case of the Liverpool and Manchester Railway, as in that of its immediate predecessor—the Stockton and Darlington—the sole object in view was the transport of merchandise between these important towns. Nor (although the experience of the Stockton and Darlington line had proved the practicability of using steam power) had that indispensable feature of the modern railway system been regarded as essential. The project was originally designed as a common road, and, as in the case of the earlier railway, the promoters were authorised to demand toll from all who might desire to transport goods upon it. Stephenson himself was not quite clear as to whether stationary or locomotive engines were preferable, and, accordingly, in

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1829, he was appointed to visit the different coal districts, along with Joseph Locke, James Walker, and John M. Rastrick, with a view to collecting information on the respective merits of the two systems. The result, we are told, was a report inclining in favour of the locomotive system, which at length, but not without much hesitation and doubt, it was decided to adopt.[1]

Even at this date, however, the potential achievements of the locomotive were unknown and undreamt of. It was suggested, in the case of the Liverpool and Manchester railway, that *possibly* locomotive engines might be constructed to draw merchandise wagons at a speed of *ten or twelve miles an hour!* The directors of the company, therefore, considered whether this rate of speed might not attract passenger traffic to their line. When the "Rocket" engine, on being put to her ever-memorable test, proved a capacity for travelling at the rate of twenty-nine miles an hour, the directors at once determined to make provision for passenger traffic, as an important feature of their business. The railway was opened to the public in 1830, and the passenger traffic immediately assumed such dimensions that, of the thirty stage-coaches that had previously run daily between the two towns, only one remained on the road, and that one was supported solely by passengers to intermediate places not lying in the direction of the railway.

But although the problem of the rapid and efficient transportation of both goods and passengers by locomotive power was thus clearly and satisfactorily solved in 1830, the new system was not destined to have everything its own way. The obstructionist tactics that had previously been directed against stage-coaches[2] and canals were now

[1] *Edinburgh Review*, October 1846, p. 483.

[2] Macaulay mentions that when flying coaches began to run between London and the chief provincial towns, about 1669, it was gravely recommended that no public carriage should be permitted to have more than four horses, to start oftener than once a week, or to go more than thirty miles a day.

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levelled at the innovation which was largely to supersede both. Many towns petitioned against having railways brought near them, and demanded that railways and canals alike should be kept several miles from their borders. The vested interests of stage-coach proprietors and carriers offered a strenuous opposition to the new system. The medical faculty were pressed into the service of the opposition, with direful forebodings as to the physical evils that would follow from travelling at the rate of thirty to forty miles an hour. Country squires set up a howl as to the devastation that railways would work on their fox-covers. Territorial magnates joined in the crusade, on the ground that the sparks from the locomotives would fire their plantations and destroy the amenities of their demesnes. Canal proprietors urged that they had already provided all the facilities necessary for heavy traffic, and that it would be grossly unjust to them to allow a rival interest to step in and deprive them of the fruits of their efforts and expenditure.[1] In some cases railway companies were forbidden to use any "locomotive or movable engines" without the consent of the owners and occupiers of lands through which their line passed. Railway engineers and surveyors were not permitted to carry out their surveys without resorting to either force or strategy. Large sums of money were extorted for the purpose of buying off opposition. Many wiseacres pronounced that the system would, after all, prove a failure, and the *Quarterly Review* of March 1825 remarked oracularly that "as to those persons who speculate on making railways general throughout the kingdom, and superseding all the canals, all the wagons, mail and stage coaches, post-chaises, and, in short, every other mode of conveyance by land and by water, we deem them, and their visionary schemes, unworthy of notice."

[1] It is related that the Duke of Bridgewater, when congratulated by Lord Kenyon on the success of his new waterway, replied, "Yes; we shall do well enough, if we can keep clear of those cursed railroads."

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Mr. Clifford states that "from the beginning of the century until the year 1824 an average of one Act a year was passed for the construction of new railways, though there were several amending statutes applicable to lines already sanctioned, and chiefly intended to relieve existing companies from financial difficulties. In the year 1825–6 eighteen new railways were authorised. There were about five in each subsequent year until 1836, when statutory powers were obtained for the construction of twenty-nine new lines, and in the following year fifteen others were authorised. In 1838, 490 miles of railway were open for traffic in England and Wales, and about fifty miles in Scotland. The cost of constructing these lines amounted to £13,300,000. A reaction followed upon what afterwards appeared the mild excitement of 1836–7. It seemed that railway enterprise had almost expended itself. Of new projects brought forward there were few, while there were numerous amending Acts, seeking further time for the completion of lines, or larger capital powers, and speculators were deterred by finding how greatly almost every railway exceeded its estimated cost."[1]

Since the year 1840 the railway system has grown steadily, not in the United Kingdom alone, but throughout the civilised world. The graduated steps of that growth are traced in some degree in the succeeding chapters of this book. As, however, this does not profess to be a history of the railway system, as such, we need not further pursue the historical vein as regards British railways. A glance at the development of railways in some other countries may, however, be permitted.

France and Belgium were among the first European states, after Great Britain, to resolve upon, and inaugurate, a system of railway communication.

Belgium having, by the revolution of 1830, become separated from Holland, lost the mouths of the Scheldt as

[1] "A History of Private Bill Legislation," vol. i. p. 85.

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an issue for its commerce. This circumstance, and the consequent pressing exigencies of their trade and industry, led the Belgian people to determine on railway development, and on May 1st, 1834, the Chambers adopted a project for the construction of a series of railways at the cost of the State, under circumstances to be more particularly dealt with hereafter. On the 1st June 1834 these railway works were commenced, and ten years later 348 miles had been constructed. At the present time, this small State has over 2700 miles of railway, being a greater mileage, relatively to territory, than any other country in the world.

In France, to quote Dudley Baxter, "the success of the Manchester and Liverpool railway provoked some real, though short, railways, especially those from Paris to St. Germain and to Versailles. But in 1837 only 85 miles had been opened, against nearly 500 miles in England. In 1837 and 1838, the French Chambers threw out a scheme of their Government for the construction by the State of an extensive system of railways, but granted concessions to private companies for lines to Rouen, Havre, Dieppe, Orleans, and Dunkerque. These lines were abandoned for a time in 1839 from want of funds. In this emergency, Mr. Locke, the great English engineer, restored the fortunes of French railways. Assisted by the London and South-Western Company and Mr. Brassey, with subventions from the French Government, subscriptions from English shareholders, and a powerful corps of English navvies, he recommenced, carried through the line from Paris to Rouen, and from Rouen to Havre, and fairly gave the start to railway enterprise in France."[1]

The impetus thus given to railway construction in France, ultimately resulted in the establishment of half-a-dozen main lines of communication, all radiating from Paris. In order to open up the country districts, and con-

[1] Paper on "Railway Extension and its Results."

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nect them with the great trunk lines, the Emperor proposed to the companies an extension of the ninety-nine years of their concessions, the division of nine millions sterling of the net revenue of the old lines among their shareholders, thus giving them a guaranteed dividend of 6 to 8 per cent., and the issue of debentures for 124 millions—the estimated cost of the new lines—with a State guarantee of 4 per cent. interest and ·65 sinking fund, designed to pay them off in fifty years. On these terms the six great French companies undertook the construction of about 1000 miles of new line each, which have since been known as the *nouveau réseau*, or extension railways.[1] From this point, however, railway development appeared to languish in France, until, under agreements made between the Government and the six leading French railway companies in 1883, provision was made for the construction of 6900 additional miles of railway, which will bring the total mileage of the country up to about 25,000 miles, the Government guaranteeing to the companies a minimum dividend equal to their recent average, and meanwhile finding the money necessary for construction by annual instalments spread over seventy-four years, at the end of which time the whole system reverts to the State.

In Germany, railway construction was undertaken at a late date, and without any comprehensive plan. The earlier lines were built for local purposes. Each State followed its own course, and kept its own individual interests exclusively in view. The railways were protected for thirty years against the construction of parallel lines. The first line built by the State, as such, was con-

[1] The mileage originally constructed by the six great companies was known as the *ancien réseau*—the old lines, and embraced 4525 miles in all. For a number of years past these lines have paid dividends ranging from 7·1 per cent. on the Eastern, to 13·5 per per cent. on the Northern systems.

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structed in 1848, and connected Berlin with the Russian frontier. Before the war—that is, in 1869—Germany had 11,396 miles of railway, and France 10,429. In the next six years Germany built 5888 miles of railway, and France only 3263. Within recent years France has constructed a considerably larger mileage than Germany.

No reference to railway development, however perfunctory and superficial, would be complete unless it included the United States—a country that has gone ahead of all the rest of the world in the matter of railway mileage, and has now a total extent of railways that is practically equal to that of the whole of Europe.

The railway system of the United States was commenced in 1830. The dates at which the initiative in railway building was taken by the several groups of states are given in the Census Report for 1880 as—

Group.	Year.
In the Middle States	1830
„ Southern States	1830
„ New England States	1834
„ Central Western States	1842
„ Western trans-Mississippi States . . .	1856

The total mileage completed in 1830 was about 40 miles. From that time till 1880 the average annual length of railway built was 1733 miles. There has, however, been as much as 10,000 miles constructed in a single year.

In 1880 there were 1174 railroad corporations in the United States. Of this number 553 were lessors, whose roads were operated by others. The remainder operated their own lines, and 131 of them also leased and worked the roads of the smaller corporations. These companies collectively possessed—

87,801 miles of main lines.
4,562 „ double lines.
15,706 „ third track and sidings.

The circumstances under which other countries acquired

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their railways need not be dealt with here. But with a view to showing the extent of railway constructed in each country relatively to area and population, the two tables that follow have been compiled. The details are almost entirely applicable to the year 1883. In some cases it has been possible to give figures for a later date, but to have done so would have tended to vitiate the relevancy and parallelism of the comparison. With regard to population, the most recent census returns have been relied on, and these, in the great majority of cases, apply to the years 1880 or 1881.

Population of the Principal European and other Countries, total Length of Railways Opened in 1883, and Extent of Population to each Mile of Railway.

Countries.	Population.	Miles of Railways Opened.	Population to each Mile of Railway.
United Kingdom	36,400,000	18,864	1,930
United States	50,152,000	120,519	416
France	37,321,000	17,684	2,110
Germany	45,234,000	21,910	2,065
Austria-Hungary	37,800,000	12,151	3,111
Italy	28,459,000	5,693	4,999
Spain	16,634,000	5,218	3,188
Belgium	5,720,000	2,721	2,102
Holland	4,225,000	1,261	3,400
Russia (in Europe)	86,359,000	14,478	5,965
Sweden	4,565,000	4,032	1,132
Norway	1,925,000	822	2,342
Denmark	1,969,000	1,005	1,959
Switzerland	2,846,000	1,673	1,701
Portugal	4,160,000	940	4,424
Canada	4,324,000	8,805	491
British India	253,941,000	10,317	24,614
Cape of Good Hope	1,122,000	969	1,158
Victoria	882,000	1,199	736
New South Wales	781,000	850	919
Queensland	226,000	633	357
South Australia	293,000	667	439
Western Australia	30,000	72	417
Tasmania	118,000	172	686
New Zealand	500,000	1,258	397
Totals and average	625,987,000	253,913	2,465

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This table is at once instructive and suggestive. It shows that there is yet an enormous work to be done before the standard of adequate railway service has been fully attained. Between the 416 inhabitants to the mile of railway found for the United States and the 24,614 found for British India there is a great gulf, which must be partially, although it may never be wholly, bridged over. The table is suggestive, in respect that it raises the question of how far railways may still be extended before the requirements of the world are supplied. It is obvious that, if the standard of adequate railroad service is to be tested by the experience of the United States—that is to say, if we are ever to reach the standard of one mile of railway to every 416 inhabitants—we should have to reckon ultimately, not with the 253,913 miles of railway shown in the table, but with over 1,500,000 miles. If, however, the relation of railway mileage to population in the United Kingdom were to be accepted as the proper standard, we should then have to look to a total of about 320,000 miles, or about 68,000 miles more than the extent already provided.

All such speculations, however, are necessarily speculative and hypothetical. No two countries either possess, or are ever likely to have, precisely the same relation of railway mileage to population. The temper and habits of the people, the character of their trade, and especially their commercial relations with other nations, their fixed or migratory habits, and many other factors, equally manifest and potent, and perhaps equally variable, must necessarily affect this problem.

In the next tabular statement the relation of railway mileage to geographical area is set forth for the principal countries of the world:—

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Area of the Principal European and other Countries, total Length of Railways Opened in 1883, *and Extent of Railway Mileage Open to each* 100 *Square Miles.*

Countries.	Area, Square Miles.	Length of Railways Open, in Miles.	Square Miles per Mile of Railway Open.
United Kingdom (1884) .	121,305	18,864	6.4
United States . . .	3,008,400	120,519	25.0
France	204,028	17,684	11.5
Germany	208,368	21,910	9.5
Austria-Hungary . .	240,262	12,151	19.8
Italy	124,380	5,693	21.8
Spain	195,702	5,218	37.5
Russia (in Europe) . .	1,887,713	14,478	130.4
Sweden	170,928	4,032	42.4
Norway	121,740	822	148.1
Denmark	14,759	1,005	14.7
Switzerland . . .	15,976	1,673	9.5
Portugal . . .	34,595	940	36.8
Belgium	11,373	2,721	4.2
Holland	12,680	1,261	10.0
Canada	3,470,392	8,805	394.1
British India . . .	1,377,540	10,317	133.5
Cape of Good Hope . .	213,636	969	220.5
Victoria	87,884	1,199	73.3
New South Wales . .	309,175	850	363.7
Queensland . . .	668,224	633	1,055.6
South Australia . .	903,425	667	1,354.5
Western Australia . .	975,920	72	13,554.4
Tasmania . . .	26,375	172	153.3
New Zealand . . .	104,403	1,258	83.0
Totals and average .	14,509,183	253,913	57.2

In this case the results brought out are so very different to those shown in the previous statement as to place it beyond all doubt that population and area cannot be simultaneously adopted as the tests of adequate railway service. The question then occurs, To which of the two tests can this problem be most suitably brought? If to that of area, then the United Kingdom is one of the best equipped countries in the world, being excelled only by Belgium. If to that of population, then our Colonial dependencies and the United States are far and away better off than any European countries.

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It will probably, however, be found that both population and area must be regarded, in varying degrees, if we are to attempt to solve this problem of the future of railway enterprise. There would be little present gain from laying down railways in a country with a great area and a sparse population. On the other hand, a country with a dense population, but a very limited area, does not afford the same scope for railway extension as a country in which both area and population are of large extent.

Mr. Edward Atkinson has calculated[1] that in Massachusetts there were in 1881 one mile of railway to every four miles of area, and has based thereupon a computation of the probable future railway requirements of the United States. In doing this, he has taken the ultimate requirements of one group of states as equal to that of Massachusetts; of a second group, as one-half as much; of a third group, as one-quarter as much; of a fourth group, as one-eighth as much; and of a fifth group (the Territories), as one-sixteenth as much. The result is shown in abstract in the following statement:—

Group.	One Mile of Railway to every	Existing Mileage in 1881.	Mileage Required to Complete Service.
No. 1 . .	4 square miles	36,236	76,211
No. 2 . .	8 „ „	27,199	48,280
No. 3 . .	16 „ „	34,472	54,473
No. 4 . .	32 „ „	9,652	15,767
No. 5 . .	64 „ „	9,888	14,494
	Totals . .	117,447	209,225

When these 209,225 new miles have been completed, there would then be 1 mile of railway to every 15 square miles of territory; or, in other words, the United States

[1] "The Railroad and the Farmer," and "The Metaphysics and Mechanism of Exchange."

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(omitting Alaska) would then be about one-quarter as well served as Massachusetts is at the present time.

This is perhaps assuming too much. If we were to reckon on an average of 1 mile of railway to every 15 miles of area throughout the countries that we have just tabulated, the ultimate result would be, not 253,913 miles, as laid down in 1883, but close on a million miles!

What is there to prevent the realisation of this estimate? With the single exception of Western Australia—of the interior of which comparatively little is yet known—there are few physical or geographical obstacles in the way. The countries in question are nearly all in the temperate zone, and have fertile territories, with increasing populations, which are mostly distinguished by the highest attributes of civilisation.

But our observations have become somewhat too speculative, if not a trifle chimerical, for a work that aims at practical results. They are, indeed, only intended to point to the possibilities that lie in the future, and if they necessarily do so with an uncertain index, they are none the less instructive as showing what some countries have already achieved, and what remains to be done by others that are still lagging in the race.

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CHAPTER II.

RAILWAY CAPITAL.

THE enormous capital that has been expended in the construction of railways in different parts of the world is one of the most remarkable features of railway history. It is, moreover, a feature common to all countries alike, although, of course, in varying degrees. It is not, perhaps, so much a matter of surprise that a rich country like England should succeed in raising more than 800 millions sterling for the purpose of providing ways of communication. This sum, enormous though it is, represents but a moderate percentage on our accumulated wealth. But what shall be said of the relatively large sums raised by much poorer countries—of the 465 millions raised by Germany, the 264 millions raised by Austria, the 91 millions raised by Spain, and the 285 millions raised by Russia? The means whereby this capital has been raised for railway development is, in truth, one of the most remarkable of modern economic phenomena.

England, as the pioneer of railway enterprise, was naturally called upon to make the first essays in the financing of railway lines. The capital required for the construction of the Stockton and Darlington Railway was very largely raised in these two towns, but it was, after all, of very inconsiderable amount.[1] The Liverpool and

[1] The author has shown, in his "Jubilee Memorial of the Railway System" (Longmans, 1875) how and by whom the capital was provided.

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Manchester Railway, which was next in order of date, was a more ambitious and costly venture. It was calculated by an eminent engineer that it would cost £227,000 to cross Chat Moss alone, a distance of only four miles. The actual expenditure so incurred, however, was not more than £40,000, and the whole capital required for the undertaking was readily subscribed by the merchants and manufacturers of Lancashire, on whose initiative it was constructed.

The experience which was gained as a result of the opening of the Liverpool and Manchester Railway led to a very large number of railway schemes being put forward, and investors were attracted to embark in these by the most alluring promises as to their financial results.

In a general way, these promises and anticipations were to a large extent realised. Some of the earlier lines were not constructed in an expensive manner. The Liverpool and Manchester Railway was, indeed, an exception, having cost £1,195,000 up to the end of 1835, or about £38,500 per mile.[1] The London and Birmingham Railway, which in 1837 had reached a total cost of £3,981,000, as against an estimated expenditure of £2,400,000, was another.[2] But these, and other lines in which the original estimates of cost were more or less largely exceeded, were constructed under special difficulties. The impression became general that, in new lines, these special causes of heavy expenditure would be got rid of. Hence the number of applications to Parliament for railway Acts increased from year to year, and, as already stated, the speculation in railway property had, by 1837, become a mania.

In 1837 the restrictions imposed by Parliament on the facility for obtaining railway Acts checked this specula-

[1] This amount was made up of £885,000 for roads and tunnels, £248,000 for warehouses and stations, and £61,000 for rolling stock.

[2] This was largely caused by the difficulties met with in making the Kilsby tunnel, which was estimated to cost £90,000, but actually absorbed about £350,000.

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tive fever, caused the abandonment of many projects, and even prevented the further prosecution of lines already begun.[1] Hence, although more than fifty new lines, comprising 1600 miles, were sanctioned in 1835–6–7, only five new lines, comprising 92 miles, were sanctioned in 1838 and 1839.

From this date little was done in railway development for several years. In 1840, no new line was sanctioned by Parliament. In 1841 there was only one line of 5¾ miles added to the list of railways for which Acts were obtained.[2] In 1842 three new railways were authorised, but none of them of large extent; and in 1843 the number of new Acts for original or branch lines was also small. This brings us up to the period of the memorable railway epoch of 1845–46, which was soon to transform the slow pace at which railways had hitherto proceeded into a rush of unexampled and devastating force.

"In 1845," says Mr. Dudley Baxter,[3] "most of the great lines had proved a success. The London and Birmingham was paying 10 per cent., the Grand Junction 11 per cent., the Stockton and Darlington 15 per cent., and railway shares were, on an average, at 100 per cent. premium. The railway mania broke out with redoubled violence; railways appeared an El Dorado. The number of miles then open was 2148. The number of miles sanctioned by Parliament in the three following sessions was—

1845	. .	2700 miles.
1846	. .	4538 „
1847	. .	1354 „
Total	.	8592 „

Had all these lines been constructed, we should have had, in 1852, more than 10,700 miles of railway, a number which was not actually reached till 1861, or nine years

[1] "Railways, Past, Present, and Prospective," by R. M. Martin. London: 1849.

[2] This was a line from Hereford to Ware.

[3] Paper on "Railway Extension and its Results."

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later. But the collapse in 1846 was so severe that an Act was passed for the purpose of facilitating the dissolution of companies, and a large number of lines were abandoned, amounting, it is said, to 2800 miles."

There is, in truth, nothing in the history of English finance that is more remarkable than the annals of railway construction between 1835 and 1845–46. In the former year there was a railway mania beginning to develop itself, consequent upon the successful establishment of the great trunk lines between the metropolis and the north. Numerous projects were put forward, and the country was mapped out with projected lines. Parliament, however, by imposing restrictions on the facilities for obtaining Acts, checked the speculative fever for the time, and but little was done in the direction of sanctioning new lines until 1844, when twenty-six lines, branches, and extensions were authorised, extending over a distance of 797 miles, and calculated to require a capital expenditure of rather over 11 millions sterling, or about £14,000 per mile. In the following year 225 Bills relating to railways were introduced into Parliament, of which 120 were passed, and 105 either rejected, withdrawn, or deferred. Of the 120 Acts passed, 107 related to the construction of new lines, and provided for making 2883 miles of new railway, for which about 44 millions sterling was created as share-capital, giving an estimated average of rather over £15,000 per mile. The following statement shows the growth of the capital account of English railways during the four years ending 1847 (£1 = 1000):—

Year.	Capital Authorised		Capital Actually Paid on Shares to Date.	Debt Incurred to Date.
	By Shares.	By Loans.		
1844	£15,596	£4,857	£47,810	£24,541
1845	44,876	14,622	63,399	25,048
1846	95,625	36,087	94,171	32,006
1847	34,152	10,060	126,149	40,788

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It has sometimes been made a subject of remark and surprise as to how so large a capital as some £79,000,000 was found by the British public for railway enterprises within these four eventful years. In all the records of British investments there has never, probably, been a parallel to this subscription of capital within an equally limited period. Nor would it, perhaps, excite so much wonder if the same effort produced a similar result at the present day, considering how enormously the national wealth has meanwhile expanded. The seventy-nine millions sterling subscribed for railway extension in 1844–47 would probably represent, in relation to the wealth of that period, a much larger sum than twice the amount would do to-day, when the total assessments to income-tax represent many times as much per year as they did then.

An economic writer[1] has endeavoured to answer the question just propounded. He has found that the accumulated dormant or fixed capital of the country in 1844 amounted to 926 millions sterling, without taking into account the value of the land—which was calculated at 1000 millions—or of buildings, which was reckoned at 500 millions additional. Of this accumulated capital, the items most readily convertible were—

Savings-bank deposits	£28,000,000
Deposits in other banks	50,000,000
Bank of England stock	14,553,000
East India stock	6,000,000
Paid up capital in public and private banks	69,000,000
Shares in gas, water, and other public companies	80,000,000

Besides these several items, there were, of course, all the various descriptions of consols available for constructing British railways, unaided by the Government, and without the necessity of creating paper money or fictitious capital.

But even these large reserves of accumulated wealth could not continuously be drawn upon, and especially in view of the alarming fact that as the new lines were

[1] Martin on "Railways, Past, Present, and Prospective."

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opened the dividends fell away, until the percentage of profit on capital expended had decreased from 5½ per cent. in 1845 to 3½ per cent. in 1849 and 3⅜ per cent. in 1850. The dividends available in the last-named year left scarcely anything for ordinary shareholders. This circumstance would have put an end for a time to further developments, but meanwhile the system of amalgamating a number of smaller concerns into one large company had been growing into favour, and in this manner eleven powerful corporations had been formed, which divided the greater part of England between them. By amalgamations, guarantees, preference stocks, and other financial expedients, these companies were able to construct a considerable additional mileage, for which the capital could not have been raised in the ordinary way. New railways were thus opened out between 1850 and 1858 at the rate of about 400 miles per annum.

The capital required for these undertakings had, however, been raised by many different, and not always sufficiently valid, processes. Two of the best known and most largely employed expedients are known as *loan notes* and *Lloyd's bonds.*

Grave financial disasters were threatened by the use made of these documents. In 1884, loan notes were legalised as securities, but it was at the same time provided that any railway company issuing loan notes or other similar instrument "purporting to bind the company as a legal security of money advanced otherwise than under the provisions of some Act or Acts of Parliament" authorising such a course, should forfeit a sum equal to the amount of the securities issued. Lloyd's bonds were an ingeniously devised form of security designed to evade this provision. They were issued as securities for debts contracted, other than for cash advances, in excess of a railway company's Parliamentary powers for raising money. The Committee of the House of Lords in 1864, after considering this proceeding, saw no remedy against it, beyond taking away

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from the creditors the right to seize the stock and stop the traffic of the company. The Railway Securities Act of 1866, however, did a great deal towards placing railway finance on a sounder footing, by providing that each railway company should register half-yearly, at the office of the Registrar of Joint-Stock Companies, a statement showing specifically the condition of its capital account in reference to loans, mortgages, debentures, &c., and the amount remaining to be borrowed.

The power of a railway company to borrow is now generally limited by its special Act to one-third of the share capital.

This provision is, however, not uniformly adhered to in practice, as the following abstract shows with regard to a number of leading lines and the three kingdoms, as such:—

Company.	Stock and Share Capital. £1 = 1000.	Loans and Debentures. £1 = 1000.	Total Capital. £1 = 1000.	Percentage of Loans, &c., on Total Capital.
Great Eastern	£27,371	£12,320	£39,691	31
Great Northern	26,668	8,393	35,061	24
Great Western	53,952	17,335	71,287	24
Lancashire and Yorkshire . .	30,265	9,359	39,624	24
London and North-Western . .	74,965	24,957	99,922	25
London and South-Western . .	20,722	7,035	27,757	25
London, Brighton, and South Coast	17,695	5,609	23,304	24
London, Chatham, and Dover .	17,459	7,722	25,181	31
Manchester, Sheffield, and Lincoln	18,542	7,550	26,092	29
Metropolitan	8,283	3,048	11,331	27
Midland	57,645	17,178	74,823	23
North-Eastern	43,367	13,549	56,916	24
South-Eastern	16,430	5,395	21,825	25
Total for England . . .	495,594	169,461	665,055	25
„ „ Scotland . . .	79,098	21,556	100,654	21
„ „ Ireland	25,703	10,050	35,753	28
„ „ United Kingdom . .	600,396	201,068	801,464	25

The foregoing statement shows, as might be expected, that Ireland has raised a larger proportion of her total

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railway capital by loans and debentures than either of the other two countries. The circumstances of Ireland, were, however, in every way peculiar. Under the several Acts authorising the advance of money out of the Consolidated Fund for public works, considerable sums have from time to time been advanced to aid in the construction of Irish railways. In 1865 the total amount so advanced amounted to £2,364,300, of which £1,208,748 had been repaid. In another respect, part of the Irish railway capital was exceptionally provided. The Midland Great Western Company was assisted by a guarantee from the baronies through which it passed of 5 per cent. upon the capital required for certain extensions. The baronies were called upon to levy rates for the purpose of this guarantee during many years. Finally, in 1866, an advance of £500,000 was granted by Parliament to certain Irish railway companies for a period not exceeding twelve months, to enable them to meet pressing liabilities.

On looking into the subject of the capital expenditure on British railways, it will be found that there is a remarkable disproportion between the amount raised by loans and debentures, or as guaranteed capital, and the amount held as ordinary stock. Between 1874 and 1884 the different descriptions of capital increased as under:—

Ordinary capital, from £248,528,000 to £298,983,446, or 20 per cent.

Guaranteed capital, from £71,207,480 to £95,603,613, or 34 per cent.

Preferential capital, from £129,723,140 to £205,809,234, or 60 per cent.

Loans and debenture stock, from £160,437,061 to £201,068,074, or 25 per cent.

At the latter date, therefore, the ordinary capital only formed 37 per cent. of the whole, as compared with 40 per cent. of the whole in 1874, while the preferred capital, &c., was 61 per cent. of the whole in 1884, and 59 per cent. of the whole in 1874.

Of the £298,983,446 of ordinary capital above stated,

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over 42 millions received in 1884 no dividends whatever, while more than 27 millions received dividends under 3 per cent.

It has been held by high financial authorities that, in order to be a commercial success, a railway should not cost more than ten times the amount of its yearly traffic; or in other words, the annual traffic should be £10 per cent. of its capital cost. But if they are to be measured by this test, the railways of the United Kingdom would be found decidedly wanting. There has hardly been a single year during which the railways of the United Kingdom, taken as a whole, have met this test. In 1854 the gross receipts amounted to only 7 per cent. of the total capital expenditure. In 1870 they had risen to 8 per cent.; in 1873, 9.8 per cent.; in 1875, 9.7 per cent.; in 1880, 8.9 per cent.; and in 1884 they were 8.8 per cent. of the capital cost. As between 1873 and 1884, there was, therefore, a decrease of about 12 per cent. in the gross earning power of capital, which is attributable, not to the falling off in the gross receipts per mile open, which had in the interval increased by £126, or nearly 4 per cent., but to the very great additions made to capital expenditure, which had risen from an average of £36,174 to one of £42,486 per mile.

Even, however, if railways are laid down and carried on in strict conformity to the rule that the capital expenditure shall not be more than ten times the amount of their gross annual revenue, this, of itself, will not suffice to make them eligible investments. There must also be a limitation in the matter of working expenses, for it obviously matters little what the gross revenue may be, if it is practically all swallowed up in the expenses of carrying on the traffic. In order to pay a dividend of £6 per cent., on a line conducted on the principle just laid down, the working expenses should not exceed £40 per cent. of the revenue. There are, however, few English lines to which this limitation applies, and on the railways of the United Kingdom, as a whole, the working expenses are 53 per

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cent. of the gross receipts. The proportion of the working expenditure to the total receipts, has, moreover, been increased from year to year for a number of years past, so that the relation of net to gross receipts has been getting worse, instead of better, for investors, as such.

There is some reason for believing that, considering the generally safe character of the investment, and the average rates of discount and prices of consols over a series of years, the railway companies of this country are paying higher rates of interest than they ought to do, though on this point one can hardly pronounce definitely without taking a very wide survey of the course of the money market generally, and the range and tendencies of rival securities.

On the 34¼ millions appropriated in 1884 to the payment of dividends on railway capital in this country, 12¾ millions were expended in the payment of dividends averaging 4.24 per cent. on guaranteed and preference capital, and 8½ millions in paying dividends averaging 4.21 per cent. on loans and debenture stock.

This shows a lower average rate of dividend than that paid some ten or twelve years ago. In 1874, for example, the average dividend paid on guaranteed and preferential capital was 4.52 per cent., and on loans and debenture stock 4.28 per cent. In the interval, therefore, there has been a decrease of .28 in the average dividend paid on guaranteed, and of .07 per cent. in that paid on loans and debenture capital.

In neither case does the decrease appear to be a large one; but it may be pointed out that in the case of the guaranteed and preferential capital invested at the end of 1884, amounting to 301½ millions sterling, the reduction of .28 per cent. in the rate of dividend is equal to £842,800, or roughly 2.4 per cent. on the total amount available for dividend in that year.

This considerable amount, then, has gone towards a further reduction of the expenses of carrying on our railways within the last few years, and furnishes a still

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stronger evidence of their capacity for improvement as an investment.

It is not too much to hope that railway boards may see their way to borrow money on more advantageous terms. At a time when the value of all equally secure investments is so high as it is now, and has been for many years, 4.24 per cent. seems a needlessly high rate of interest to pay for preferential and guaranteed capital. If any good company were now going into the market to borrow at 3.5 per cent., there is little doubt that its requirements would be immediately met, and the payment, therefore, of anything above that rate would seem to be a wilful and unnecessary waste of resources.[1]

So far as the capital raised for the construction of foreign railways is concerned, it has been obtained in a multitude of different ways, which it would be both tedious and unnecessary to attempt to describe. In France, Germany, Belgium, and indeed in most Continental countries, it has been obtained under State guarantees, or as a direct result of valuable State concessions. In the United States, Canada, South America, our Australian Colonies, and some other countries, capital has been raised for railway extensions, partly as a result of land grants conceded by Government, partly in consequence of special loans borrowed on security of local rates, and partly as a result of contributions made by local authorities, and in respect of which the districts through which the railways were carried have voluntarily taxed themselves.

There is only one country that can show the same amount of capital raised by private subscription as the United Kingdom. That country, it need hardly be added, is the United States, which has performed much more remarkable prodigies of railway finance than even England has succeeded in accomplishing.

[1] Since this was written the New South Wales Government has borrowed 5½ millions at 3½ per cent., and could have had the loan subscribed several times over.

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In 1871 the total capital raised for the construction of railways in the United Kingdom was 552½ millions sterling. In the same year the United States had raised 555¼ millions sterling, or about 3 millions more.

In 1884, however, the capital invested in United States railways stood at 1599¼ millions sterling, being an increase of 1044 millions sterling, or 190 per cent. on 1871. The capital embarked in the railways of the United Kingdom had, in the same interval, increased by 249 millions, or 45 per cent.

Between 1871 and 1884 the capital expended in American railways had increased by £20 for every man, woman, and child in the United States in the census year 1880. In the United Kingdom the increase of railway capital during the same interval would represent only about £7 per head of the population of 1881.

The United States, therefore, have within this period added nearly three times as much to their fixed investments in railways, relatively to population, as the United Kingdom.

It is often made a source of complaint in America that the capital of that country is being converted too quickly into fixed investments, and the fact that 1044 millions have been embarked in railways alone within so short a period would seem to justify this impression. But, on the other hand, it is contended that this money has not been withdrawn from other forms of investment or modes of employment, but has actually been furnished, for the most part, from the savings in freight charges effected by and through the railways themselves. If we consider that the annual value of these economies is not short of 100 millions sterling a year on the present annual traffic movement of the United States, and that this sum would suffice to construct about 8300 miles of railroad per annum, at the present average annual cost of the whole American railway system, it would seem as if this remarkable claim were really substantiated. It is certainly true that the

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decrease effected on the transport of the goods traffic of the United States as a whole, as between 1871 and 1882, was quite equal to furnishing the capital that is now annually added to the account of American railway construction.

With reference to the Continent of Europe, the following table shows in what way the capital has been raised in certain countries, to the end of 1883, so far as the particulars are available [1]:—

Statement showing the Capital Expenditure of the Railways of Different European Countries (£1 = 1000).

Countries.	Share Capital.	Subventions.	Obligations.	Loans.	Total.	Per Cent. of Total Raised as Share Capital.
	£	£	£	£	£	
Germany (private lines) . .	30,683	300	25,021	2,846	58,850	52
Austria-Hungary .	90,065	2,270	210,351	4,165	306,851	29
Belgium—						
State lines . .	...	3,593	...	30,488	34,081	...
Companies' lines .	3,717	54	4,426	...	8,197	45
France . . .	64,685	106,885	289,473	...	461,043	14
Luxembourg . .	1,500	...	290	...	1,790	84
Norway . . .	5,284	...	...	387	5,671	93
Holland (private railways only) .	6,124	36	5,836	68	12,064	51
Russia—						
State lines . .	1,753	...	5,416	...	7,169	24
Companies' lines .	72,896	...	168,124	...	241,020	30
Switzerland . .	14,043	4,516	22,676	...	41,235	34
Totals . .	290,750	117,654	731,613	59,954	1,177,971	Average 25

There is a striking disparity in the proportions of share and loan capital raised in different countries, as shown in

[1] "Statistique de chemin de fer de l'Europe."

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this table. In France the proportion of the total railway expenditure raised as share capital appears to be as low as 14 per cent. In Norway, on the contrary, share capital represents as much as 93 per cent. of the total. Between these two extremes there would appear to be every degree of intermediate proportion. Over the whole sum of 1178 millions sterling dealt with in the table, the average raised as share capital is about 25 per cent., which, it will be noted, is closely approximate to the average so raised in the United Kingdom. An average made up of such extremes as 14 and 93 can hardly, however, be regarded as of much statistical utility.

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CHAPTER III.

COST OF RAILWAY CONSTRUCTION.

THERE is nothing in the economics of railway working that varies more than the cost of construction. A railway may be made either cheaply or expensively, according as the purchase of the land involves a large cost or a small one, as the permanent way is light or heavy, as labour is cheap or dear, as the line is level or the reverse, as there is a larger or a smaller proportion of double and treble mileage. The problem is also affected and complicated by many minor considerations, of which we cannot stay to take account.

For these and other reasons, it is not always, nor indeed generally, a foregone conclusion, that a line that has cost an exceptionally high sum relatively to its mileage is necessarily a line in which economy has been wanting. The mere arithmetical process of dividing the mileage into the total cost of making a line does, indeed, afford an index to the capital expended, and therefore to the amount that must be realised in order that a certain dividend may be paid upon the cost of construction; but it affords no just criterion whereby to calculate whether the line should have cost more or less by comparison with other lines, whether the capital has been wastefully spent, or whether the results are likely to justify the expenditure.

In considering the average cost incurred in the laying out and equipment of railways, regard must, therefore, be had to the special circumstances of each country and of each railway, as regards alignment, labour, land, and many

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other physical and economic features by which the outlay is regulated and determined.

In the United Kingdom, the average cost of the railways constructed to the end of 1884 amounted to £42,486 per mile. The only other European country that approaches this average is Belgium, where the cost to the end of 1883 was £36,508 per mile. France follows some distance behind, with an average of £27,704 per mile, while Germany has only run to £21,236 per mile. In Russia (in Europe) the average falls to £20,000 per mile, and in Scandinavia the average has not in any case exceeded £10,000. In the United States, for reasons to be hereafter more fully considered, the average is rather over £11,000 per mile, disregarding "watered" stocks.

The greater average cost of English railways is mainly due to the greater cost of land, the greater strength and stability of the permanent way, the larger proportion of double line, the more difficult alignment, the heavy cost of Parliamentary contests, and other points that will be dealt with as we proceed.

It would be very interesting, if it were possible, to arrive at a just estimate of the total cost incurred by the railway companies of the United Kingdom in the purchase of land. There is, however, no means whereby this item can be ascertained, short of making specific inquiries as to the cost incurred for each separate line. That very large sums were expended in conciliating opposition, over and above the amounts actually spent in consideration of the supposed or adjudicated value of the land, is one of the best known facts in English railway history. In the case of our large towns the price paid for land has been naturally large, and may, in many cases, have borne something like a fair relation to its market value. But there are many cases in which fabulous prices have been paid for purely agricultural land, sometimes, ostensibly, because it was held that it would be damaged by the railway being allowed to traverse it.

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In 1868 a return was ordered by Parliament, on the motion of Mr. Childers, of all the land held by the railway companies of the United Kingdom, or by companies leased by them, which is calculated to throw some light upon the question of what proportion of the total area of the country is under railway control. The total amount of land thus held, so far as returns were received—and the returns received embraced all the lines of any importance —was 253½ square miles, being an average of 12.32 acres per lineal mile of railway. This figure is equal to an average width of land of 102 feet over the whole, including, of course, land for stations, sidings, and other purposes, and surplus land. If the ratio of land to mileage constructed is the same now as it was then, the railways of this country would own at the present time about 235,000 acres in all. If the value of this land is calculated at £100 per acre, it would amount to a total sum of 23½ millions, which is less than 3 per cent. of the total capital expenditure on the railways of the United Kingdom to the end of 1884. Obviously, however, this computation is much more curious than reliable, since the cost incurred by railways in the acquisition of land must have been much higher than any such figure.

It is sometimes said that the principle upon which compensation has been awarded to landowners for the compulsory acquisition of their property has been altogether wrong. It is, at any rate, entirely at variance with the principles and practice of ordinary business affairs in other walks and relations of life. In what other commercial transaction do we find the one party paying to the other a very exorbitant price for the privilege of vastly improving the property of the party to whom such price is paid? And yet this is exactly what has occurred in the case of the dealings of railways with landowners. No one, nowadays, will be found to dispute that in a general way a railway very greatly improves the value of landed property, whether for agriculture, industry,

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or *ordinary* residential purposes. There is, however, a class of property, employed for what may be called *extra-ordinary* residential purposes, that is deemed to be injured, instead of being improved, by the proximity of a railway —such property as fox-covers and deer-forests, which is used by those who "neither toil nor spin" for purposes that are equally outside the scope of toiling and spinning. But why should a railway be compelled to pay an extravagantly high sum because it proposes to acquire a piece of land that forms the demesne of a lordly mansion? Why should land so used be deemed to be of less value when regarded in reference to purposes of local rating, and of more value when considered from the point of view of compulsory purchase? The railway has generally so greatly improved the value of all productive landed property that the owners of such property ought, in strict equity, to compensate the railways for the improvement so effected. But this is a plea that even the railways themselves would be slow to urge. What they do urge, and have urged, is, that it is the reverse of fair that they should confer great benefits upon the community as a whole, and upon every section of it, as such, and at the same time be required to pay a high premium for the privilege of conferring such benefits. And what is the character and incidence of that premium? There is not, so far as we are aware, any record of the exact proportion of the total capital expenditure that British railways have laid out in the purchase of land. But we may be under the mark if we put the average at £4000 a mile, and there are many cases in which it has been ten and twenty times that amount.[1] At £4000 per mile the railways of the United Kingdom will have paid about 76 millions, or one-tenth of their total capital expenditure for the possession of some 235,000 acres of land, giving an average of

[1] The Manchester and Leeds Railway cost for land £6150 per mile; the London, Birmingham, and Great Western, £6300; the South-Western, £4000; and the Grand Junction, £3000.

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only £323 per acre, and it happens, somewhat curiously, that they own about $\frac{1}{323}$ part of the area of the United Kingdom. It comes, then, to this, if our assumption of average cost is near the mark, that for the purchase of this 323d part of the total area of the United Kingdom, our railways have, as a whole, paid about one-twelfth of the estimated current agricultural value of the whole land of the country. And those who have compelled them to do this have at the same time been profiting, in many cases enormously, by the additional value imparted to the land that was not acquired by the railway, in consequence of the facilities for transport, not previously available, that were thereby furnished. Truly the landed interest have much to thank railways for! Will they ever light upon such another El Dorado?

Another very substantial cause for the greater cost of English railways is the larger proportion of double or treble mileage, and of sidings, than in other countries. It appears that at the end of 1884 there were double lines or more:—

In England,	8504	miles	out of	13,340,	or 64	per cent.
„ Scotland,	1161	„	„	2,999,	„ 39	„
„ Ireland,	574	„	„	2,525,	„ 22	„

These figures, however, come very far short of showing how the proportions of single and double mileage really stand in Great Britain. There is, in fact, no record of the mileage of sidings, or of the treble and quadruple mileage that is so general on English railways, but is seldom to be found on those of other countries. These several additions will not be likely to add less than 20 per cent. more to the total track of England and Wales, considered as such, and would bring up the total single mileage in England and Wales from 13,340 to over 24,512 miles.

In Continental countries, there are very considerable differences in regard to the mileage of single and double lines. In Germany, Belgium, and France, the total mileage laid down, considered as single track, is more than double

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the total lineal mileage open; but in other countries the mileage of double track is less considerable, as the following figures show[1]:—

Statement showing the Length of Single and Double Railway Track in the Principal European Countries, in Kilometers.

Country.	Single Line.	Double Line.	More than Double.	Sidings, &c.	Total Track.	Percentage of Total.	
						Main Lines.	Sidings, &c.
Germany . .	24,369	10,381	59	14,207	59,526	76	24
Austria-Hungary	17,349	1,780	...	4,718	25,627	82	18
Belgium . .	2,332	1,364	...	1,792	6,852	74	26
Denmark . .	1,577	45	...	256	1,923	87	13
France . .	18,577	9,928	18	7,286	45,773	84	16
Italy . . .	8,556	626	...	1,626	11,434	86	14
Luxembourg .	127	22	...	29	200	86	14
Norway . .	1,258	...	...	121	1,379	91	9
Holland . .	1,369	584	...	729	3,266	78	22
Roumania . .	1,380	9	...	234	1,632	86	14
Russia . .	19,348	3,989	...	5,513	32,839	84	16
Finland . .	812	20	...	161	1,013	84	16
Switzerland .	2,274	424	...	581	3,703	84	16
Totals .	99,328	29,172	77	37,253	195,167	...	...

It will be observed from these figures that the average cost per lineal mile, or, as it is more commonly expressed, per mile open, does not follow in strict correspondence with the extent of double mileage or more. In other words, it is not always the country that has the largest proportion of track to mileage open that shows the highest average cost per open mile. If this principle were to be observed throughout, France should show a lower average cost per mile than Germany, whereas the cost of French

[1] These figures are taken from the official "Statistique des chemins de fer de l'Europe, pour l'année 1882, et resultats généraux de cette Statistique pour l'Exercise, 1883." The figures are published as in the original.

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railways has averaged about £6500 per mile more than those of the Fatherland.

The above table also shows, as might be expected, that the greatest proportion of siding accommodation, &c., is provided by the countries that have the largest industrial traffic, Belgium taking the lead, and Germany, Holland, Austria, and France, each following in the order given, although not strictly in the order of the magnitude of their traffic.

A more serious source of heavy first cost in railway construction than even the multiplication of sidings and double and treble lines is known to engineers as the conditions of the alignment and gradients.

It needs not to be demonstrated how much more cheaply a railway may be constructed where there are no embankments, cuttings, or viaducts, and but few bridges, than in a case where the physical configuration of the country involves a very serious expenditure in respect of these items.

There is very little published information as to the exact circumstances of English railways in this regard. Generally, however, there is little reason to doubt that England and Scotland are, by reason of their undulating characteristics, certainly not more favourably situated than the majority of Continental railways in the matter of alignment. The gradients, also, on some railways that run through what, for England, may be regarded as a comparatively level country are decidedly heavy, and on a few leading lines, such as the Lancashire and Yorkshire, they are very bad indeed.

For Continental Europe the conditions of the gradients and curves have been statistically ascertained, and are presented in tabular form in the following statement[1]:—

[1] "Statistique des chemins de fer de l'Europe pour l'année 1882."

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Statement showing the Average Conditions of Continental Railways as regards Gradients and Curves.

Country.	Level Line.		Gradients of 1 to 5 per 1000.		Gradients of 6 to 10 per 1000.		Gradients of 11 to 15 per 1000.		Maximum Gradients.	Minimum Radius of Curves.
	Kilometres.	Percentage of Total.	Kilometres.	Per Cent.	Kilometres.	Per Cent.	Kilometres.	Per Cent.	Per 1000.	Metres.
Germany	10,815	31	15,671	45	6,397	18	1,472	5	33	50
Austria	4,801	26	8,885	47	3,381	17	1,203	6	35	30
Belgium (not including State lines)	177	27	313	48	119	18	41	6	18	250
Denmark	636	39	639	40	334	20	13	1	13	330
France	6,939	24	10,716	38	6,533	23	3,866	...	45	50
Italy	2,184	24	4,065	44	2,402	...	...	...	35	180
Luxembourg	52	35	22	15	43	29	19	13	20	200
Norway	343	28	328	26	422	33	111	9	24	188
Holland	1,215	62	655	33	56	2	14	1	20	100
Roumania	370	27	647	47	288	20	50	3	28	200
Russia	8,268	35	7,089	30	7,519	32	418	2	45	128
Switzerland	731	26	704	25	744	26	289	10	250	60

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It appears from these *data* that the most advantageously situated country in Continental Europe as regards railway gradients is, as might be expected, the Netherlands, where 95 per cent. of the whole mileage is under 5 in 1000, and 62 per cent. is perfectly level.

Germany, the adjoining country, comes next to Holland in this regard, with 31 per cent. of level, and 45 per cent. of gradients of 1 to 5 in 1000, making 76 per cent. of the whole mileage under 5 in 1000. Austria and Belgium come but a very little behind Germany, the former having 73 per cent. and the latter 75 per cent. under 5 in 1000. France, however, as a consequence of the highly mountainous character of some of her more southern provinces, has to contend with much more difficult gradients, having only 24 per cent. of her total system on the level, and 38 per cent. more under 5 in 1000. It may further be remarked that fully 10 per cent. of the total mileage of all her principal lines, including the Nord, the Est, the Ouest, the Midi, and the Paris and Orleans railways, has gradients of 16 to 20 in 1000.

Of European countries, the one with the heaviest gradients is Switzerland, which has only 26 per cent. of her whole system on the level, and 25 per cent. more in gradients of less than 5 in 1000. About 5 per cent. of the Swiss railway mileage has gradients of 16 to 20 in 100; about 6 per cent., gradients of 21 to 30 in 1000; and 2 per cent., above 30 in 1000. The Righi railway is, of course, in the last-named category, as well as 24 per cent. of the Appenzell line, 13 per cent. of the Lausanne-Echallens, and 72 per cent. of the Rorschach-Heiden railways.

In the United States, there has been collected, for the Report of the Tenth Census, a great mass of information bearing upon the profile and alignment of the several railways, from which it would appear that the conditions of the grading, as regards the Middle, Western, and Southern States are certainly not worse than in Great Britain. This information, however, is not put into a

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form that enables it to be readily compared with the data given above for Continental Europe.[1]

It will again be found, however, that the highest cost of construction is not always identical with the worst profile and alignment, as an analysis of the tables shows, although this, as we have elsewhere remarked, has a not unimportant influence on first cost.

The amounts that have been expended in the United Kingdom in promoting and opposing Bills in Parliament have been enormous. According to a return presented to the House of Commons in 1883, a total expenditure of £3,924,712 had been incurred on this account between 1872 and 1882. As the increase of railway capital in the United Kingdom during the same period was 198 millions, it follows that the amount spent over Parliamentary battles was 2 per cent. of the total addition to capital expenditure in these ten years. If it were correct to assume that the same percentage of the total capital expenditure had been wasted in Parliamentary contests over the whole of our railway history, the aggregate sum so spent would amount to about *sixteen millions sterling*. It is probable, however, that the actual expenditure has been greater even than this, since the fights were much fiercer, and more costly in proportion to the capital involved, in the earlier history of the system than in its later stages of development.[2]

On some English railways there has been a wasteful expenditure of capital in other ways. The Commission of 1867 gave a remarkable example of how much the useful capital of a company may be increased by the mode in which it is raised. Out of the whole capital of the London, Chatham, and Dover line in 1865, amounting to £16,683,000, not less than £4,109,000 was admitted to

[1] "Statistical Report on the Railroads in the United States," by A. E. Sherman, p. 447.

[2] Some specific examples of this waste of capital, and its relation to results, will be found in a succeeding chapter.

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have been dissipated in obtaining the rest from the public, and £1,948,000 more was disbursed out of capital for payment of interest and dividends.[1]

There is reason to believe that this is not by any means a solitary case. When the railway mania was at its height, many millions were frittered away in a similar fashion.

The capital expenditure on English railways has been swollen inordinately by an equally common and scarcely more creditable expedient. It was at one time a very prevalent custom for a railway company to distribute shares among its proprietors at par when the existing shares were at a premium. This practice first originated in special Acts, which authorised the raising of additional capital to complete a line when the original estimates had proved insufficient. It was a custom justified, according to Mr. Clifford,[2] "on the plausible ground that to the shareholders, who had run the risks, belonged whatever advantages might accrue from the enterprise when its success was assured;" and it was maintained that "they were as much entitled to the benefit of new capital legitimately required for the completion of their railway as if this capital had been included in the original estimate." The question naturally occurs, "Who was to determine what capital was so required?" There can be little doubt that this pernicious system tended to greatly increase the capital expenditure, and to "water" the stock of English lines beyond all legitimate requirements. Indeed, Mr. Clifford expressly declares that in this way "enormous sums were realised by shareholders in the great companies," and he mentions, as a specific example, the case of the London and Birmingham Railway, in which the shareholders received from the issue of new shares, down to 1846, more than 4¼ millions, while their original outlay was 5¾ millions. In another railway—the York and

[1] Report of the Royal Commission on Railways.

[2] "A History of Private Bill Legislation," vol. i. p. 129.

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North Midland—each shareholder who had acquired an original £50 share received upon that £250 in the way of premiums.[1]

It must, however, in all fairness, be borne in mind that in the building up of our great railway system other exceptional expenses were incurred in a more legitimate manner. Some of these were thus referred to by Mr. Dudley Baxter in 1867:[2]—

"1. The English expenditure includes, on a probable estimate, no less than £40,000,000 sterling absorbed by metropolitan railways and termini. This of itself is £4500 per mile on the 8890 miles constructed.

"It also includes very large sums for termini in Manchester, Liverpool, Leeds, Sheffield, Birmingham, and other great towns, far beyond what is paid in Continental cities.

"2. The English expenditure also includes considerable capital for docks, as at Grimsby, where £1,000,000 was laid out by the Manchester, Sheffield, and Lincolnshire Company; and at Hartlepool, where £1,250,000 was spent by a company now merged in the North-Eastern.

"It also includes, in many instances, capital expended on steamers, and capital for the purchase of canals.

"3. The counties whose trade and population are greatest, and which are most thickly studded with railways, as Lancashire, Yorkshire, and Glamorgan, are exceedingly hilly, and necessitate heavy embankments, cuttings, and tunnels, which enormously increase the cost of construction. The Lancashire and Yorkshire Railway has cost £52,400 per mile for the whole of its 403 miles. Had those counties been as flat as Belgium the company might probably have saved something like £20,000 per mile, or £8,000,000 sterling. The Manchester, Sheffield, and Lincolnshire Company, even after deducting £1,000,000 for the docks of Grimsby, have spent £53,000 per mile. A

[1] Evidence of George Hudson before the Select Committee of 1846.

[2] "On Railway Extension and its Results." Paper read before the Statistical Society.

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flat country might have saved them a similar sum per mile, or £5,000,000 sterling.

"4. England, as the inventor of railways, had to buy experience in their construction. Other nations have profited by it. There is no doubt that our present system of lines could now be made at very much less than their original cost. In addition, we have paid for experiments, such as the broad gauge and the atmospheric railway."

We now propose to inquire into, and to endeavour to find adequate replies to, the two following questions:—

(1.) To what extent has the capital expenditure upon English railways varied as between one period and another?

(2.) What have been the principal causes of these variations, and how far have they been justified by the results?

As collateral to these inquiries, we shall further endeavour to ascertain whether the railways of the United Kingdom have shown a higher or a lower capital expenditure, as between one period and another, when compared with Continental and American lines.

The following statement shows how the average cost per mile has increased, as between different periods, in constructing English railways:—

Year.	Miles Open.	Cost (£1 = 1000).	Capital Outlay per Mile.
1838 . .	540	£ 13,300	£24,630
1843 . .	2,390	82,348	34,450
1851 . .	6,890	248,240	36,029
1861 . .	10,869	362,327	33,335
1871 . .	15,376	552,680	35,944
1874 . .	16,449	609,895	37,078
1884 . .	18,861	801,464	42,486

showing that the average cost per mile of line opened has

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largely, although by no means steadily, increased, until in 1884 it was close on double what it had been in 1838.

It seems not a little curious, on the face of it, that England, which can purchase most of the articles required in railway construction more cheaply than any other country, should show this remarkable increase of capital per mile open. The increase has not been of anything like the same amount in other countries, as we shall subsequently see.

Between 1873 and 1884 the total capital outlay upon the railways of the United Kingdom rose from 588⅜ to 801½ millions sterling. In the same interval, the mileage of open railway increased from 16,081 to 18,681 miles. The 2783 miles of railway constructed in the interval thus represented, as measured by the concurrent increase of capital expenditure, an average of about £77,000 per mile, whereas the average capital expenditure per mile open throughout the country was at the earlier date £36,574, and at the later date £42,486 per mile.

It is not without interest to ascertain how this great increase of expenditure, averaging £5912 per mile open throughout the United Kingdom, has been distributed within the three kingdoms. Its apportionment is shown in the following return:—

	Average Capital Expenditure per Mile in	
	1873.	1884.
England	£42,533	£49,800
Scotland	25,800	33,520
Ireland	13,723	14,160

from which it would seem that the increase per mile amounted to £7267 in the case of England, £7720 in the case of Scotland, and only £437 in the case of Ireland.

Taking the average of the kingdom as a whole, the increase has been a fairly steady one, and has not been a thing of leaps and bounds in one year, to be followed by stationariness the next. It might reasonably be expected that the principal leap would have occurred in or about

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the year 1873, when the cost of both labour and materials took a very remarkable upward movement. But the increase in 1873 over 1872 was not more than £590 per mile open, and in 1874 it was only £504 per mile over 1873. Neither increase was equal to that which occurred in some subsequent years, when the same disturbing elements were not at work to anything like an equal extent, if at all. Thus, for example, the average of 1882 was £586 above that of 1881, although in 1882 there was a generally low range of prices and labour costs. The fact is, that it is difficult to account satisfactorily for the increase of capital cost, except, as we shall hereafter see, in so far as it has been entailed by increased provision for the safety of passengers and the accommodation of traffic.

The enormous increase of capital expenditure relatively to mileage that has happened since 1872 is all the more difficult to explain when we find that for some years before the movement was in rather a contrary direction. Thus we find that in 1856 the average capital expenditure was returned at £35,315 per mile. In 1860 this had fallen to £33,368 per mile, and in 1863 it was as low as £32,804, or £9682 less than the average of 1884. It is obvious that if the average of 1863 had never been exceeded, the present capital outlay on the railways of the United Kingdom would have been standing at about 185 millions less than it actually is, and that the possession of this difference would have enabled the railways of the country to work at a much lower range of rates and fares than they are now accustomed to charge. In point of fact, this difference would have represented an annual increase of over 1 per cent. to the average dividends earned by British railways.

Into the causes of the very serious increase of capital expenditure, to which allusion has been made, we shall not attempt to enter. They are declared by railway apologists to have been mainly the creation of facilities

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for meeting an extraordinary increase of traffic, and to some extent this plea is undoubtedly a good one. But it should not be forgotten that in most other leading countries there has been an almost corresponding increase of traffic without a corresponding increase of capital cost. In the United States, for example, the increase of capital expenditure per mile of railway open, as between 1872 and 1883, was only £2092, although the increase of traffic in that country was infinitely greater in the interval than in the United Kingdom. In Germany, as between 1870 and 1883, the average capital expenditure per mile rose from £17,771 to £21,236, being an increase of £3465 per mile; and in France, during a rather shorter interval, the capital cost has actually decreased by £3613 per mile. Italy has followed the same excellent course as France, having diminished the average capital cost from £19,944 in 1872 to £19,434 in 1883 per mile open.

The truth of the matter appears to be, that the British railway companies have launched out more or less largely into expenditure that scarcely comes within their legitimate business of common carriers. They have become steamboat owners, refreshment-room and hotel proprietors, manufacturers of permanent way materials and other commodities, dock and harbour builders, and have added numerous other functions of minor importance to that which was their original, and is still believed by many to be their only true and proper one. Whether the results have fully justified these new departures is a moot point, upon which the best authorities fail to agree.

It must, however, be recollected that in the case of the United Kingdom there have been no special terms or advantages accorded to railway companies, as there have been in some other countries. They have all along had to fight, like Hal o' the Wynd, for their "ain han'," and they have been beset by exorbitant claims and the levying of black mail on every side. In the United States, on the contrary, as we have elsewhere explained, the Government has

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conceded special privileges, such as land-grants, that have largely reduced the cost of construction.

Some of the Canadian lines, again, have received from the Dominion Government remarkable concessions in land and money. The Canadian Pacific received a grant of 25 million dollars in money as a loan, and 25 million acres of lands fit for settlement, as well as the right of way, station grounds, dock privileges, and water frontage, in so far as these are vested in the Government. Besides this, the Government undertook to construct and transfer to the Company, free of cost, 714 miles of railway, the value of which is estimated at 30 millions of dollars. The Company is further privileged to import steel rails and other materials used in construction free of duty, and to build branch lines, with right of way and other privileges. But this is not all. The stations, buildings, equipment, and capital stock of the Company are to be free from taxation for all time, and lands granted by it within the North-West Territories are also to be free from taxation for twenty years, unless sold in the meantime; while, finally, the Company is protected from the construction of competing lines for twenty years from the date of its charter. Upon the capital stock of the Company, which is 100 million dollars, the Dominion Government has guaranteed a minimum dividend of 3 per cent. per annum for ten years. In 1884 the Company received from the Government a further loan of 22½ millions of dollars.

In some of the chapters that follow, and especially in Chapter xxii., there will be found additional *data* bearing on the cost of railway construction in the colonies of Great Britain.

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CHAPTER IV.

RAILWAYS AS INVESTMENTS.

THE subject of this chapter is one of such very wide scope that we can only hope to deal with it here in the most superficial, if not perfunctory manner. To adequately present the infinitely diversified aspects of railway property as investments would exhaust a great deal more scope than has been proposed for the present work as a whole. Many of these aspects, moreover, are touched upon more or less fully in other sections of this book. There cannot, indeed, be any important phase of railway economics that does not in some manner, direct or reflex, bear upon the character and tendencies of that description of property from an investor's point of view.

Since it is no part of our purpose to deal with the special circumstances, as regards administration of particular railways, so it will be no part of our aim, in this chapter, to refer to particular lines in reference to their financial position and prospects. We seek to cover a wider area, and to occupy a larger, and not, we trust, a less useful field, in attempting to analyse and diagnose the more salient features of railway property, as such, from a national, or even international, rather than a merely local aspect.

One of the first things that strikes the inquirer into this subject is the remarkable uniformity of the average range of dividends paid in all countries in which railway property is not subsidised. Another remarkable feature of

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this description of investment is, that it does not appear to yield more than a certain average range of dividends, no matter how much the property may have improved, nor how great the economies that may have been introduced in its working.

The reasons for these phenomena are not far to seek. Until and unless railway property yields a certain amount of profit, which may be above or below the average of the safest investments otherwise available, but does not usually greatly differ therefrom, there is no inducement to construct further lines that are designed to be self-supporting. Another equally manifest characteristic is, that if the range of dividends yielded by railways should exceed a certain average—which may be described as the normal or usual one—the effect is to draw into such investments a larger amount of capital than can be remunerated on the same scale, and hence there is a fall of dividends until the normal average has again been restored by abstention from further developments.

So far as the United Kingdom is concerned, there have only been three years since 1854 when the average rate of dividend yielded on the capital invested in British railways, as a whole, fell below 4 per cent. Those years were 1862, when the average was 3.86 per cent.; 1863, when it was 3.99 per cent.; and 1867, when it was 3.91 per cent.

It is not less remarkable that over the same period there have only been three years when the average rate of dividend was above 4½ per cent. Those years were 1871, when it was 4.66 per cent.; 1872, when it was 4.74 per cent.; and 1873, when it was 4.59 per cent.

But although the *average* rate of dividend earned by British railways over this period has exhibited this somewhat striking uniformity, the component parts of that average have shown the most singular variations. There have, besides, been considerable differences as between the three kingdoms.

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The average rate of dividend earned on all railway capital in 1884 was as under:—

For England and Wales . . .	4.27 per cent.
„ Scotland	3.6 „
„ Ireland	3.5 „

from which it appears that the average of England and Wales is considerably higher than that of either of the sister countries. The average for all three countries would, however, be considerably higher than it is if the dividend-paying lines only were to be considered. There is, unfortunately, a very large proportion of the capital invested, embracing not only ordinary but preferential, and to a less extent guaranteed capital as well, upon which no dividend has been paid for years; and there is another large proportion upon which the dividends paid are under 2 per cent. For each of the three kingdoms these proportions were, in 1884, as under:—

Countries.	Ordinary Capital Receiving		Preferential Capital Receiving	
	No Dividend.	Not Exceeding 2 per Cent.	No Dividend.	Not Exceeding 2 per Cent.
England and Wales	£34,446,000	£13,258,098	£ 9,733,635	£458,000
Scotland. . .	4,908,673	3,514,267	134,780	81,670
Ireland . . .	2,831,202	867,900	651,109	129,159
Totals . .	£42,185,875	£17,640,265	£10,519,524	£668,829

Of the total railway capital of the United Kingdom, amounting to 801 millions sterling at the end of 1884, it thus appears that 5.1 per cent. of ordinary capital received no dividend whatever in that year, while 2.2 per cent. received not more than 2 per cent. If, however, we take the total ordinary capital, as such, it appears that 14.4 per cent. of it received no dividends in 1884, and 6 per cent. received less than 2 per cent.

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On the other hand, however, it must not be overlooked that 65½ millions of ordinary capital, or 8 per cent. of the whole, received between 5 and 6 per cent., 60 millions between 6 and 7 per cent., and 6½ millions over 7 per cent. More than 44 per cent. of the total ordinary capital was thus in receipt of upwards of 5 per cent.

The following tabular statement shows the proportions of the ordinary capital of the railways of the United Kingdom upon which no dividends have been paid since 1870 (£1 = 1000):—

Years.	Total Ordinary Capital.	Amount of Ordinary Capital upon which no Dividends were Paid.	Percentage of Ordinary Capital on which no Dividend was Paid.
1870 . .	£229,282	£31,266	14
1871 . .	230,234	30,098	13
1872 . .	239,039	29,791	12.4
1873 . .	244,449	34,111	14
1874 . .	248,528	41,121	16.6
1875 . .	254,600	...	...
1876 . .	262,008	35,675	13.6
1877 . .	265,041	38,291	14.4
1878 . .	265,675	35,281	13.3
1879 . .	266,914	41,546	15.5
1880 . .	270,496	37,973	14.0
1881 . .	275,935	36,514	13.2
1882 . .	283,574	39,160	13.5
1883 . .	293,437	41,140	14.0
1884 . .	298,983	42,186	14.1

It appears that the percentage proportion of the total ordinary capital that received no dividend over the whole of this period was pretty uniform. In other words, if the relative position of the ordinary shareholder over this period has not been improving, it has not been made materially worse.

This, however, is hardly a satisfactory state of affairs. The law of railway development is generally, and should always be, the law of progress. Especially ought this to be the case in regard to a system which has witnessed

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such a wonderful expansion of traffic as the railway system of Great Britain has done during recent years.[1]

It is not, therefore, altogether surprising to find that the growth of ordinary has not kept pace with that of other descriptions of capital during the period under consideration, as the following figures show (£1 = 1000):—

Description of Capital.	Total Amount Paid up in		Amount of Increase.	Percentage of Increase in 1884.
	1870.	1884.		
Ordinary . .	£229,282	£298,983	£69,701	30
Guaranteed . .	36,188	95,603	59,415	165
Preferential . .	122,503	205,809	83,306	68
Debenture Stock .	51,220	186,274	135,054	263

The conclusion that these figures naturally suggest is, that the position of the ordinary shareholder is not being improved in relation to other descriptions of investors in railway securities, and that the public are disposed to fight increasingly shy of ordinary stock. This is sufficiently proved by the fact that ordinary capital only represented 37 per cent. of the total investments in British railways in 1884, as compared with 44 per cent. of the whole in 1870.

It is, however, important to remember that the principal railways in the United Kingdom are, as a rule, remarkably good and safe investments. The Midland, the London and North-Western, the Great Northern, the Great Western, and the North-Eastern Railways represent unitedly 338 millions of capital, or about 42 per cent. of the total of the United Kingdom, and 50 per cent. of the total railway capital of England and Wales. The average dividends paid by these five companies in 1884 was over 6 per cent. on their ordinary capital.

[1] The gross receipts from British railways increased from 45 millions in 1870 to 70½ millions in 1884.

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Each of these main lines is, however, largely made up of a congeries of smaller railways, some of which yield very excellent dividends, while others return none at all. Thus, for example, the Great Western system is made up of thirty-nine different lines, of which twenty paid no dividend whatever in 1884, while the others paid dividends ranging between ½ and 8 per cent. It is, therefore, of importance to investors to endeavour to discover what is the exact dividend-paying character and prospects of each of the many different stocks of which our principal systems are composed.

It is, again, a fact, and a striking commentary on the variable and unreliable character of railway investments, that in the year 1884, of 258 railways in England and Wales, including those leased to or worked by the great companies, 137, or more than one-half of the whole, paid no dividends whatever. Of thirty-eight railways in Scotland, in the same year, eighteen paid no dividends, and only six paid 5 per cent. and upwards. Ireland was in a worse case still, having thirty-four lines out of fifty-one that paid no dividends on the ordinary capital.

The foregoing facts may be thus summarised, with a view to showing the statistical position of the railways throughout the nation as a whole:—

Countries.	Number of Railway Companies that Paid		Totals.
	Dividends.	No Dividends.	
England and Wales . . .	121	137	258
Scotland	20	18	38
Ireland	17	34	51
Totals . . .	158	189	347

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The fact that 189, or 54 per cent., of all the railways in the United Kingdom paid no dividends to ordinary shareholders in 1884 can hardly be regarded as a good augury for that class of stock. It is, of course, obvious that these non-dividend-paying lines must generally have been of minor importance, in regard both to their extent and the capital invested, or the proportion of the total ordinary capital that received no dividend would have been much greater than we have found it to be.

In the United States there is quite as great a disparity between the profits of different companies and the average rate of dividends earned on railway investments in different States as in the United Kingdom. It is worth while examining the special circumstances of the United States in two of their more prominent aspects—the first, that of the average rates of dividend earned over the whole; and the next, that of the averages of particular States. Both points of view are of singular interest to English investors generally, as well as to the railway world, and those whose interests are controlled thereby.

The first question that naturally occurs, in considering the subject of American railways as investments, is that of how far the traffic carried on the railways as a whole admits of further expansion; and the next, that of how far the remunerative character of the railways, as such, is likely to be affected by the wars of rates that have every now and again prevailed, with the result of forcing down profits to an extremely narrow margin. An answer to these two inquiries will be found in the following statement[1]:—

[1] The figures in this statement are taken from the "Statistical Abstract of the Principal and other Foreign Countries," issued by the English Board of Trade.

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Statement showing the Cost of Construction of the Railways in the United States, with Gross and Net Receipts for each Year from 1871 to 1884.

Years.	Cost of Construction (£1 = 1000).	Gross Receipts (£1 = 1000).	Working Expenses (£1 = 1000).	Net Receipts (£1 = 1000).	Dividend, per Cent.
1871 . .	£555,208	£84,167	£68,750	£15,417	2.8
1872 . .	658,333	96,875	69,796	27,079	4.0
1873 . .	788,541	109,791	71,458	38,333	4.8
1874 . .	879,583	101,875	68,958	32,917	3.6
1875 . .	920,000	104,791	66,041	38,750	4.2
1876 . .	931,100	103,541	64,791	38,750	4.0
1877 . .	951,675	98,541	62,916	35,625	3.7
1878 . .	956,250	102,079	63,125	38,954	4.0
1879 . .	1,015,004	109,504	58,304	51,200	5.0
1880 . .	1,125,425	127,861	74,822	53,039	4.8
1881 . .	1,308,034	140,204	82,784	57,220	4.3
1882 . . .	1,461,823	154,042	90,963	63,090	4.4
1883 . .	1,557,889	164,750	97,988	67,382	4.4
1884 . .	1,599,248	160,559	72,866	87,693	5.4

The remarkable feature of this statement is, that it proves the existence of an elasticity and capacity for improvement in all directions, on the part of American railways, that are probably unique. Since 1871 the working expenses of the system as a whole have only increased from £68,750,000 sterling to £72,866,000 sterling, being an increase of only £4,116,000, or 5.9 per cent., while the net receipts have increased by £72,276,000, or about 468 per cent.! Concurrently with this movement, the gross receipts have increased from 84 to 160½ millions, being an advance of about 76 millions, or 90 per cent. These figures, and the enormous increase of capital expenditure in the same interval—from 555¼ to 1599¼ millions—explain the remarkable fact that while the gross earning power of capital has fallen from 15 to 10 per cent., the net earning power of the same capital has advanced from 2.8 to 5.4 per cent., concurrently with a general reduction of freight rates that is computed at a total of not less than 100 millions sterling a year, or twelve millions more than the total net receipts for 1884. In the United Kingdom,

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the course of railway finance has been very different, the total traffic receipts having increased from 51¼ to 71 millions, the net receipts from 25¾ to 31¾ millions, and the working expenditure from 25¾ to about 36 millions sterling. In other words, to earn an additional 72¼ millions of net receipts, the working expenses of the American lines have been increased by a little over 4 millions sterling; but in the United Kingdom there has been an increase of over 10 millions in working expenditure to earn about 6 millions more of net receipts.

But this is not the only remarkable feature of the comparison, or, to speak more correctly, of the contrast. The railways of the United States have effected this increase of 468 per cent. in their net receipts concurrently with an enormous reduction in rates and fares, whereas in the United Kingdom any reductions that have occurred in these directions during the same interval have been immaterial. This is substantially proved by the fact that in the United Kingdom the average rate per ton carried and the average fare per passenger, have scarcely varied as between the one period and the other.

The average rate of dividend earned on railway capital is not only higher in the United States, but the proportions of the whole ordinary capital that take an exceptionally high range appear to be greater as well. Thus, it seems that in the year 1880, 3.35 per cent. of the whole railway capital of the United States earned between 9 and 10 per cent., as compared with only 0.31 per cent. in the United Kingdom; 6.28 per cent. of the whole American railway capital earned between 10 and 11 per cent., against only 0.38 in the United Kingdom; 7.97 per cent. earned between 11 and 12 per cent. against *nil* in the United Kingdom; and 6.01 per cent. earned between 12 and 13 per cent. in the United States, against 0.01 per cent. in the United Kingdom. On the other hand, however, 10.23 per cent. of the whole only received from 1 to 2 per cent. in the United States, and 9.19 from 2 to 3

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per cent., against 6.64 per cent. and 1.92 per cent. respectively in the United Kingdom. The following table, which has been compiled from the Census Reports of the United States for 1880, and the Board of Trade returns for the United Kingdom, shows the amounts of dividend paid on the total railway capital of the United States and on the *ordinary* capital of the United Kingdom, respectively:—

Statement showing the Dividends Paid upon the Capital Embarked in the Railways of the United States and the United Kingdom, respectively, in the Year 1880.

Dividend or Percentage of Profit.	Amount of Capital.		Percentage of Total in	
	United States ($1 = 1000).	United Kingdom (£1 = 1000).	United States.	United Kingdom.
Under 1 . .	$394,762	£39,030	18.77	14.43
1 to 2 . .	215,015	17,979	10.23	6.64
2 „ 3 . .	293,364	5,187	9.19	1.92
3 „ 4 . .	64,327	22,487	3.06	8.31
4 „ 5 . .	52,892	28,387	2.52	10.49
5 „ 6 . .	120,131	62,168	5.71	22.98
6 „ 7 . .	137,497	31,763	6.54	11.74
7 „ 8 . .	137,061	36,057	6.52	13.33
8 „ 9 . .	156,457	21,861	7.44	8.08
9 „ 10 . .	70,415	827	3.35	0.31
10 „ 11 . .	132,184	1,036	6.28	0.38
11 „ 12 . .	167,561	...	7.97	...
12 „ 13 . .	126,505	30	6.01	0.01
13 „ 14 . .	52,768	...	2.51	...
14 „ 15 . .	336	1,110	0.02	0.41
15 „ 16 . .	5,969	Nil.	0.28	...
16 „ 17 . .	2,026		0.10	...
17 „ 18 . .	260		0.01	...
18 „ 19 . .	5,086		0.24	...
19 „ 20 . .	54,030		2.57	...
20 „ 21 . .	2,614		0.12	...
22 „ 23 . .	280		0.01	...
23 and upwards	11,516		0.55	...
Totals .	2,103,068	270,496	100.00	99.03

The foregoing statement is very instructive. It proves unmistakably that American railways are, in the main,

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both very much better and very much worse, regarded as investments, than those of England. There never, probably, has been a year in the history of English railways when 18.77 of all the capital expended in their construction paid under 1 per cent. dividend, and yet this was the condition of things in the United States in a year when business was so generally prosperous as that of 1880. It will be observed, again, that 38 per cent. of all the capital invested in American lines paid less than 3 per cent., while only 23 per cent. of the capital invested in English lines was in that condition. On the other hand, however, over 26 per cent. of all the United States railway capital paid over 10 per cent., as compared with less than 1 per cent. of the total railway capital of the United Kingdom. These facts would seem to prove that American railways are a much greater lottery than English, and that they require to be much more closely looked into. It is, of course, necessary to remember that a considerable section of the American railway system, including the two Pacific lines, was largely built at the cost of the State, with a view to opening up the country, whereas the State has done nothing whatever on behalf of English lines, which have all been constructed as private enterprises.

In the United States, as in most foreign countries, the funded debt of the railways bears a considerably higher rate of interest than in the United Kingdom. On the fifteen leading American lines, having a net income equal to the payment of 9.2 per cent. average dividends upon their stock in 1880, and actually declaring average dividends of 5.0 per cent. for that year, the average rate of interest paid on a funded debt of 655½ millions of dollars was 5.6 per cent. But the average was made up of rates varying from a minimum of 3.1 per cent. in the case of the Union Pacific to a maximum of 8.2 per cent. in the case of the Wabash, St. Louis, and Pacific Line. In England the rate of dividend payable on loans and deben-

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tures varies from 3½ to 4½ per cent., the average for each description of capital in 1884 being—

Ordinary capital	4.34 per cent.
Guaranteed capital	4.42 „
Preference capital	4.16 „
Loans	4.20 „
Debentures	4.22 „

The best-paying lines in the United States are those of the New England and Middle States. In 1884 the percentage of net income on the total cost of the railways and their equipment was—

For Massachusetts	5 per cent.
„ Rhode Island	8 „
„ Connecticut	5 „
„ New Jersey	5 „
„ Pennsylvania	10 „
„ Maryland	6 „

On the other hand, however, there have been very low average rates of dividend earned in most of the Western, South-Western, and Pacific States, including—

For Ohio	3 per cent.
„ Minnesota	3 „
„ Iowa	2 „
„ Arkansas	1 „
„ Wyoming	1 „
„ California	3 „

On the Continent of Europe the average rate of dividend does not greatly vary from that earned by railway capital in England. There is, however, a distinction to be made between State and private or companies' lines. In regard to the former, they are often constructed without any immediate expectation of their being a source of profit, whereas private companies generally make this the *ne plus ultra* of their plans and operations. The effect of this condition of things may be traced in the following figures:—

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Dividends Earned on State and Private Companies' Lines in European Countries.

Countries.	Average Rate of Dividend Earned in 1883 on	
	State Lines.	Private Lines.
	Per cent.	Per cent.
Austria	2.49	4.46
France	0.37	5.14
Norway	1.40	6.71
Russia	0.24	4.89

In addition to the State lines and the private lines, as such, there are, in some Continental countries, private lines worked by the State, and State lines worked by private companies. The following detailed statement shows the average rates of dividend earned on all four classes, and on the system of each country, as a whole, in 1882:—

Statement showing the Percentage of Net Receipts on Total Capital Expenditure of European Railways in 1882, distinguishing State from Private or Companies' Lines.

Countries.	State Lines.	Private Lines Worked by State.	Private Lines.	State Lines Worked by Private Companies.	Average of all Lines.
Germany . . .	4.63	5.45	4.56	...	4.68
Austria	2.49	2.56	4.46	0.63	3.98
Belgium . . .	5.62	...	5.00	...	4.03
Denmark . . .	1.88	...	...	2.71	2.18
France—					
Lines of general interest	0.37		5.14	0.12	4.77
Lines of local interest .	...	...	0.89	...	...
Italy	3.70	...	2.17	...	...
Norway	1.40	...	6.71	...	1.90
Holland . . .	...	...	5.40	3.00	4.09
Roumania . . .	2.61	...	0.52	...	2.06
Russia	0.24	...	4.89	...	4.75
Finland	4.54	...	...	...	4.54
Switzerland . . .	...	...	3.67	...	3.67

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It would be a mistake to base on these figures any judgment as to the differences that distinguish private from State lines in reference to their management. It happens, no doubt, in a few cases, as in those of Germany and Belgium, that the State lines yield a higher rate of dividend than the others. That, however, may be merely due to the accident of their traversing districts in which there is a greater amount of traffic, or in which the conditions favourable to good dividend-earning capacity are otherwise more at command.

Taking the Continent as a whole, it will be seen that the only countries in which the railways earn a higher average rate of dividend than our own are—

Germany,	with an average of	. . . .	4·68 per cent.
France,[1]	„	„	4·77 „
Russia,	„	„	4·75 „
Finland,	„	„	4·54 „

It is necessary to remember that Continental railways have not generally the same volume of traffic at command as English lines, that their gross and net receipts are usually much under those of English railways per mile of line open, and that their working expenditure generally takes a lower range. With the same extent of traffic, Continental railways would yield much higher rates of dividend than English railways, both because their capital cost is much less, and because their working expenses are lower. These points will be found more fully explained in other chapters.

In the next table the comparative results of working the State and private lines in several leading European countries are recorded for the year 1883, being a year later than that to which the figures already quoted relate:—

[1] This figure applies to the lines of general interest only, but it embraces all the important railways in the kingdom.

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Statement Showing the Financial Results of Working Continental Railways in 1883.

Countries.	Total Cost Incurred.	Cost per Kilometre Constructed.	Expenditure Incurred in Working.	Percentage of Working Expenses on Receipts.	Percentage of Net Receipts on Capital.
	(1 fr. = 1000.	fr.	(1 fr. = 1000.)		
Germany—					
State lines . .	9,656,654	305,901	534,198	55.10	4.49
Private lines worked by the State .	628,542	282,745	46,434	52.20	6.63
Companies' lines .	1,512,061	242,364	83,781	53.60	4.72
Austria—					
State lines . . .	911,178	253,952	38,162	62.53	2.50
State lines worked by private companies	87,646	180,341	3,302	77.83	1.07
Private lines worked by the State .	956,664	406,227	35,241	61.70	2.29
Companies' lines .	6,013,413	430,698	253,761	51.14	4.03
Belgium—					
State lines . . .	1,217,213	397,392	73,141	59.98	4.00
Companies' lines— Grand Cantl. Belge	139,204	242,939	7,940	53.47	4.99
Italy—					
State lines . . .	1,757	336,282	102,553	63.89	3.29
Private lines . .	1,095,234	258,920	33,636	80.28	0.82
Holland—					
State lines . . .	345,467	294,265	15,889	64.20	2.55
Companies' lines .	257,181	387,321	16,183	54.14	5.33

These returns clearly show that in Germany, Austria, and Holland, the railways constructed by the State cost, on an average, less than those laid down by private companies, and this should ultimately assist them to earn better dividends. The State lines, however, appear to show a larger proportion of their total gross receipts expended in their working in Germany, Austria, Belgium, and Holland, which is a symptom that would generally lead to a less favourable financial result.

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CHAPTER V.

LEGAL STATUS OF RAILWAYS IN GREAT BRITAIN.

THERE is no subject of greater present or prospective importance, in relation to the future of industry and commerce—not to speak of the travelling public, as such, and the community in so far as it is concerned in what is, after all, a more favourite investment than any other, not even excepting the funds—than the extent to which railway companies have received Parliamentary sanction to their several undertakings.

There is no modern function of the State that has been found more onerous and irksome than that of holding the balance evenly between the railway companies and the general public. The rights and obligations of both have often been in fierce and protracted dispute. It has been found, in a general way, that the railways, as was no doubt perfectly within their right, stuck most tenaciously to the privileges and concessions conferred upon them by the State; while the public, in so far as their interests were not identical with those of the railways, have been most jealous of the monopolies exercised by the latter, and have ever and anon called upon the State to curtail and qualify what appeared to be an arbitrary power to establish monopolies almost as great as their own—to exalt one district at the expense of another, and to show favour to interests or individuals, that was not regulated by any more obvious impulse than that of mere caprice, and was, in its results, attended with a great amount of detriment to conflicting and rival parties.

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After more than half a century's experience of railways, this question of *meum* and *tuum* remains as hotly contested, and as far from being settled, so far as present appearances go, as ever. There has been a great deal of vacillation and ill-regulated zeal over this matter. At one time it has been deemed by the Government of the day to be necessary to impose the strictest limitations on the powers possessed by railway companies. At another, those powers have been extended and confirmed, apparently without let or hindrance. Successive Governments have appointed Select Committees and Royal Commissions to inquire into the working of railways, and many elaborate reports have followed thereupon; but in very few cases has it happened that effectual checks were imposed upon the powers of the railway companies, as originally conferred, so that to-day, if we except a number of regulations that have been imposed with the view of securing the safety of life and limb, the railways of this country are as free from State control as ever they have been.

The reasons assigned for this condition of things have generally been the same, whether stated by the Minister of the day, from his place in Parliament, by a Select Committee, after a long investigation of the charters under which railway companies hold and exercise their enormous powers, or by the apologists and defenders of the railways in the press.

It is contended (1) that as an enormous capital has been invested in British railways on the faith of the privileges originally conceded by Parliament, it would be a gross injustice, amounting almost to an act of confiscation, to now withdraw the concessions which led to that capital being subscribed; and (2) that it is in accordance with the genius of English enterprise, and the proved experience of the past, that the State should interfere as little as possible with what is being adequately and efficiently performed, or capable of being so performed, by the unaided efforts of the public, as such.

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There is undoubtedly strong force in both of these arguments. It is, of course, open to the other side to argue that when Parliament granted the powers originally conferred upon railway companies, it was not anticipated, even by the most prescient and sanguine, that the system would ever attain to the colossal influence that it wields to-day, and that if the present development could have been foreseen, the regulations made by Parliament would have been framed in a manner that would have protected the public much more effectually. In proof of this, the experience of Continental nations is pointed to, where it was perceived, at a very early period, that the rights of the State over all high roads must be equally asserted over the new ways of inter-communication which were about to be substituted for them.

But while the principle that the State should retain control over the highways of the country is no doubt a sound one, it is proper to draw a broad distinction between the conditions under which railways were established in England and those that obtained on the Continent of Europe.

The first and most essential feature of this distinction is that the State neither did at the beginning, nor subsequently, undertake the ownership and control of railways in England, as it had previously done in the case of the common turnpike roads. The construction of railways was left entirely to private enterprise, which found the whole of the capital necessary for the purpose, and undertook every risk and responsibility attaching thereto. The State was simply an onlooker, and, for some years at any rate, a rather indifferent one. Quite a contrary system was pursued in other countries. In some cases it was the policy of the State to undertake, not only the construction, but the maintenance and working, of the principal lines. This fact led to the setting up of very divergent principles of control. In one country, the State used

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the transport of goods and passengers as a source of revenue. In another, regarding the facility of intercommunication and the development of industry as advantages paramount to revenue, the State fixed the tariff at so low a figure that railways were not carried on mainly as a source of profit. These main principles may, and have been, infinitely varied. Examples might be quoted where the State has either wholly or partially constructed the railways, and then let them for a term of years to a company, under a lease which usually contains clauses reserving a right of reversion to the State, and fixing the limits of maximum rates and fares, the conditions on which the State can cancel the lease, and the terms on which the line is to be surrendered by the company at its termination.

It is manifest, then, that the circumstances under which English railways have been constructed are such as to remove them, as regards State regulation, from either of the two categories with which they are generally compared—that is to say, from the category of turnpike roads on the one hand, and from that of State-constructed and State-administered lines on the other.

The Government does, nevertheless, exercise a very considerable amount of control over both the construction and the working of English railroads. This control commences, *ab initio*, with the authorisation of the undertaking, for which, and for any modification or extension thereof, direct Parliamentary sanction is necessary. Before obtaining such sanction, the promoters must comply with quite a legion of standing orders, and must "show their hand" in every particular.

The Act under which every railway in the United Kingdom has been constructed specifies the *maximum* rates and fares authorised to be charged, and the conditions under which the line is to be worked generally. It is competent for any one whose interests are liable to be adversely affected by the proposed new line to enter an appearance against it, so that it seldom happens that the

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sanction of Parliament is accorded to the whole of the railway projects put before it in any one session.

There can be no question that the system under which the railway system of the United Kingdom has been built up is attended with many disadvantages, if it may also claim to have much to recommend it. It is of great service to the public that no railway company can have any alteration made in any of the powers conferred upon it by Parliament, without submitting a special Bill, and obtaining a special Act for the purpose, while this necessity secures to the public the right of overhauling the authority of the railway company, and of opposing such provisions as are not likely to be to their own advantage. Such applications, on the other hand, necessarily add to the already enormous number of Acts of Parliament, under which the powers of the railway companies and the rights of the public are now provided for, and render it more than ever difficult to distinguish between the two. As the case now stands, there is no company that has not a more or less considerable number of different Acts, which makes it very difficult indeed to ascertain the law as bearing upon any particular case. This difficulty was present to the minds of the members of the Railway Commission of 1867, when they recommended that "when railway companies apply to Parliament for power to amend their Acts, advantage should be taken of the application to require them to consolidate all the clauses of existing Acts which remain permanently applicable to their undertaking."

Besides the obligations imposed upon them under their special Acts, railway companies are subject to the provisions of a number of general Acts. Among the obligations devolved on railway companies under these general Acts are the following:—

(1.) To afford all reasonable facilities for forwarding delivering, and interchanging traffic, without preference or delay.

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(2.) To charge equal tolls to all persons, and after the same rate, in respect of all traffic passing over the same portions of railways under the same circumstances.

(3.) That distance posts or stones shall be set up at every quarter mile along the lines of railway.

(4.) That the tolls authorised to be taken and exacted shall be published by being exhibited on a board.

(5.) To permit to be carried on their lines all goods except such as are dangerous.

(6.) To allow any persons to use a railway, with their engines and carriages, upon certain conditions.

(7.) To run at least one train each way daily, at an average speed of not less than twelve miles an hour, and to stop at every station.

(8.) To charge not more than 1d. for each mile travelled, half-price for children between 3 and 12 years, and to carry children under 3 years free.

(9). To allow each passenger to carry 50 lbs. of luggage free.

(10.) To carry soldiers and police at 1d. per mile, and officers in first-class carriages at 2d. per mile; and to carry public baggage and stores accompanying them at 2d. per ton per mile.

(11.) To allow the Postmaster-General to run trains at such times as he fixes, and at such speed (not exceeding 27 miles per hour, including stoppages) as the Board of Trade certifies to be safe.

(12.) To submit to the purchase of existing lines of railway by Parliament, after the expiration of a definite period.

(13.) To adopt an uniform gauge of 4 feet 8½ inches.

Parliament has, besides, reserved a power, in certain contingencies, of reducing the maximum tolls and rates leviable by railway companies; of passing any general railway Act which it may deem necessary for the regula-

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tion of the railway system; and of having the railways, engines, and carriages inspected by the officers of the Board of Trade whenever they think fit. It may also, when applied to, make regulations for the safe working of the traffic at the junction of the lines of two companies The Treasury has power to reduce the rate of tolls at the end of twenty-one years when the dividends exceed 10 per cent., and in some amalgamation Acts, as, for instance, that of the Great Western, the South Wales, and the West Midland Railway, the rate of interest is limited to 6 per cent.

British railway companies are free to construct and work their lines as they please, provided that they are constructed in such a way as to be capable of being worked without public danger.

Government, however, possesses a power of making regulations at junctions between the lines of two companies, and where the lines interfere with landowners' interests, as, for example, at level crossings.

Railway companies are liable, under the common law, to compensate persons who are injured; and under Lord Campbell's Act they are liable to compensate the near relatives of persons who may be killed by the negligence of either themselves or their servants.

The special Acts under which railways are, and have been, constructed in this country are divisible into three parts.

In the first place, they create an incorporated company, with power to raise capital, and with all the corporate privileges attaching to such incorporation. In the next place, they give the incorporated company the necessary powers to take land, and otherwise interfere with existing interests, in order that they may be enabled to construct their lines; and, thirdly, they regulate and define the rights of the public to use the railway, and of the company to levy tolls and charges.

The necessity for the first of these provisions arose from

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the circumstance that, in the earlier days of railways, joint-stock enterprise was in its infancy. Incorporation, with the extinction of individual liability, was regarded as a privilege, and was only granted by Parliament to enterprises or trades which it was considered could not be effectually carried on by individual capitalists or private partnership.

It follows, as a consequence of Parliament having granted to each company, in its special Act, its charter of incorporation, that when the company desires to alter the terms of that incorporation, as between the several shareholders, or to enlarge its original capital, or to vary the conditions under which the capital is to be raised, a fresh application to Parliament becomes necessary.

"It is," in the words of the Commission of 1867, "of no slight importance to the public that railway companies should be compelled to apply to Parliament for its sanction to every alteration of, or addition to, their undertakings, and that any other railway company or person affected by the change should have the liberty of being heard in opposition. The railway companies, being thus continually before Parliamentary committees, either to defend their interests against invasion or to obtain further concessions from Parliament, an opportunity is afforded to the public of bringing forward any grievances from which they may suffer, and to Parliament of imposing such fresh regulations as the public interests may require, as a condition of the new concession. Thus Parliament becomes an arbitrator between the railway companies and the public, and the railway companies voluntarily accept its decisions to promote their own objects or interests. This operates as a powerful inducement to the companies to remove any grievances of which the traders in their different districts might complain."

The Royal Commission on railways reported in 1867 that there were then about 1800 Acts of Parliament sanctioning the construction of new lines up to that time,

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and about 1300 Acts modifying the provisions of the original Acts by authorising the extension of capital, the variation of lines, the construction of additional works, the leasing or amalgamation of lines, the variation of tolls and rates, and the amendment and consolidation of original Acts, so that it had become an extremely difficult task to ascertain the precise law affecting any company, or any particular portion of its lines of railway.

This condition of affairs has greatly tended to produce and encourage litigation, and has thus provided a rich harvest for the lawyers. The consolidation of the several private Acts possessed by each company is urgently required with a view to the simplification of the relations existing between them and the general public. Not less requisite is the codification of the several general Acts, although these are by no means so difficult of comprehension. The present confusion is bad for both the railways and those whom they serve, entails upon both a great deal of expense that might be avoided, creates uncertainty as to the issue of many points that should not be left in the slightest doubt, and can be of ultimate benefit to no one outside of that numerous but undesirable class who live on the misfortunes of others.

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CHAPTER VI.

THE STATUS OF FOREIGN RAILWAYS.

A JUST comparison of the legal conditions under which railways have been constructed in different countries would necessarily involve a historical record that cannot be attempted here. The powers and prerogatives, the limitations and reservations, the principles and practice, by which railway systems are distinguished in the leading countries of the world are legion, and are varied by fresh enactments, bye-laws, regulations, and restrictions, not only from year to year, but almost from day to day. But the fundamental principles on which railway enterprise was founded at the outset have in most, if not in all, countries continued to remain practically unchanged to the present time. Each country has adopted a policy deemed at the time to be the best suited to its own special requirements. From that general policy but few departures have been made, except in matters of minor detail. We shall, therefore, attempt to expound some of the leading principles that have guided the chief countries of the world in the system of railway development, without seeking to deal with such regulations and ordinances as are apt to be constantly varied by the exigencies of experience and public necessity.

THE UNITED STATES.

There is no general Governmental control over the railroads of the United States. Since the State of New York led off, by enacting, under its "General Railroad Law," that

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"twenty-five or more persons may, without any application to the Legislature, associate themselves, and by so doing become a body corporate, authorised to do any act necessary in the construction, operation, or maintenance of a railroad," this example has been generally followed by other States, so that railroads can be built anywhere or everywhere. The right so conceded carries with it that of taking lands for railway purposes, on paying their value. Thus the State Legislatures "were at once relieved of one of the most troublesome subjects that ever came before them." The advantages of this absolute freedom of action are thus described by Mr. Poor:[1]—

"There is hardly a person in the Northern and Western States that does not live within the hearing of the whistle of the locomotive engine. The necessity of railroads was everywhere so pressing that a great many lines were built by people living along them, not with the expectation of direct income, but for the incidental advantages which they secured. Great success in the form of dividends was certain to lead to the construction of rival railroads to share in the profits of the first-comer. There was no monopoly in this right of construction. There could be no monopoly in their operations, as all were competitors for each other's business. . . . Relative to each other, in the matter of transportation, New York, Pennsylvania, and Maryland are distinct sovereignties. On the north, the Canadian lines are an equal corrective of any attempt at extensive charges on the New York lines. The extensions and ramifications of lines, that must always be rivals and antagonistic, are so complete that the business of every important section and community in the United States is now fiercely competed for—to be competed for all the more fiercely as time goes on."

This citation from a high authority affords a sufficiently exact and comprehensive idea of the general conditions under which railways have been established throughout

[1] "Manual of Railroads of the United States for 1881."

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the United States. Practically each State is omnipotent with reference to its own system. Each State accordingly frames by-laws and regulations designed to meet the special requirements of its railway traffic. No two States have precisely the same code of railway laws. In some cases the railway practice as regards traffic regulations is much similar to that of Great Britain in essential matters of detail. In other cases, as we have sufficiently shown elsewhere, it is widely different. But whatever may be the special circumstances and laws of particular States, all are alike in this, that railway corporations are exempted from general or national control to an extent that is not equalled in any other country. It must be admitted that the system has been justified by its results.

In America railway commissioners have been appointed in twenty-one States. In some cases these officers are paid by the railways; in others, they are paid by the State. The general scope of the laws under which the commissioners are appointed is said to be "to control railroads within the State;" and, it is added, that "they exercise, in many cases, a healthful influence over railroad management; but railroad transportation, strictly confined within State jurisdiction, is so limited that it leaves the real difficulties unsolved and nearly unaffected. It cannot be said that the State laws have been successful in dealing with the subject."[1] Again, "the limited jurisdiction of the State laws involves conflicts with both the general Government and the sister States. Diverse decisions have been rendered by the highest judicial tribunals of neighbouring States upon State laws of like import and purpose." As examples of this fact, it may be stated that while the Supreme Court of Iowa decided that "a railroad company has the right, as a common carrier, to make its own contracts, and disregard any laws of a State which seek to regulate shipments to ports beyond the limits of the State," the Supreme Court of Illinois decided that

[1] "Report of the Secretary of the Interior for 1882," p. 446.

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"while the Act of the Illinois Legislature of May 2, 1873, to prevent unjust discrimination in the rates of charges of railway companies, may affect commerce, it cannot be said to be a law regulating commerce among the several States, within the meaning of the Federal Constitution."

If the Supreme Court of the United States should concur with the Supreme Court of Illinois, then each State would be at liberty to enact regulations for itself, with the result of certain conflict of laws and extra-State authority, difficult, if not impossible, to define, and leading to vexatious litigation; but if, on the other hand, the decision of the Supreme Court of Iowa were supported, then the regulation of railways is a matter of exclusive Federal jurisdiction, and only Congress could legislate upon the subject beyond State lines with any effect.

The state of the laws that regulate railway property in America would thus appear to be far from satisfactory. The Constitution vests in Congress the power to regulate commerce, and this is described as applying "to all commerce with the several States, except such as is completely internal." Hence the universal use and absolute dependence of all inter-State commerce upon railroads gives constant rise to new questions, under new conditions, which only experience can properly solve.

Among the "general laws" of the United States relating to railroads is one that requires every company that has received United States bonds or grants of lands to make to the auditor of railroad accounts "any and all such reports as he may require from time to time," and to submit to his inspection all books and records, under a penalty of not less than 1000 nor more than 2000 dollars. Besides this regulation, which is strictly carried out, the Pacific companies, which have been largely constructed with Government help, are required to keep open their roads as "a public highway for the use of the Government of the United States, free from toll or any other charge," and the United States Government takes power, under the Act

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of 1862, to appoint railway commissioners, to elect directors, to call meetings of stockholders, and make other arrangements of an administrative character.

FRANCE.

In the early history of French railways the lines were generally planned, and in many cases constructed, by the Government. The line was ultimately offered to the competition of the general public, the length of the lease, the *maximum* rates and fares, and other essential facts being distinctly set forth. In a very few cases leases were granted in perpetuity, but these were mostly for mineral lines.

The railways are generally, however, conceded to the companies in leases for ninety-nine years, at the expiration of which period they become the property of the State; and in order that the debenture and share capital may be extinguished at the time the transfer takes place, a sinking fund is set aside out of the receipts from traffic, from which a portion of the debentures and shares are annually paid off or bought up.

In addition to the advantage of making direct subscriptions to the cost of construction, the Government has guaranteed nearly all the bonds issued by the companies. Sometimes the guarantee does not quite cover the cost of interest and sinking fund.

In return for this assistance the French Government has required the free performance of the postal service and the conveyance of military and other *employés* at very low rates. It has fixed lower maximum rates than England, and has required the companies to submit to considerable control, over both rates and fares, for all classes of traffic, as well as over the management. The French Government also levies a duty upon traffic of 10 per cent. upon the gross receipts from goods carried by fast trains and from passengers. The policy of the French Government has materially protected the companies in that it has not

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allowed more railways to be made than it considered would adequately accommodate each district. The result of this is that (whilst the system in vogue tends to ensure a full traffic to every railway), as a rule, those who desire to travel over or send goods by railways have to pay, besides the railway fare, an additional and heavier rate for the road carriage; whereas in England a very limited amount of road carriage will now bring passengers or goods on to the railways in any part of the country, except in mountainous and unproductive districts.

A Commission appointed by the French Government to inquire into the construction and working of railways made an elaborate report in 1863. This Commission carefully considered the prohibition from charging special rates, or rates not authorised by the Government (although lower than the tariff named in the "*cahier des charges*"), which is one of the main features of the French system of traffic, and they make some remarkable references to the necessity of special rates as a means of developing the resources of the country. They do not, however, recommend such rates, because at the time the Commission sat special rates had been prohibited in France, on the ground that they were contrary to the principles of equality.

Under the French law of 1842, the State undertook the earthworks, masonry, and stations, and one-third of the price of land. The departments were bound to pay by instalments the remaining two-thirds of the land, and the companies had only to lay down rails, maintain the permanent way, and find and work the rolling-stock. It was intended that three-fifths of the total cost should be borne by the State and departments, and two-fifths by the companies. Under this system of subventions, a number of concessions were made, the shares rose to 50 per cent. premium, and in 1848 a total of 1092 miles had been opened. The Revolution of 1848 was a terrible shock to credit, and railway shares went down to half their value.

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Many lines became bankrupt and were sequestrated, and for three years no fresh concessions were granted. But the concessions already made were meanwhile slowly completed, and by the end of 1851 France had opened 2124 miles, against 6889 miles of railway opened in the United Kingdom.

In 1852, the Emperor took the French railways in hand, and by a system which Mr. Dudley Baxter has declared to be singularly adapted to the French people, he put an end to the previously feeble management, and launched into a bold course of railway development. The French public shrank from shares without a guarantee; he gave a State guarantee of 4 or 5 per cent. interest. The French public preferred debentures to shares; he authorised an enormous issue of debentures. The companies complained of the shortness of their concessions; he prolonged them to an uniform period of ninety-nine years. At the same time, he provided for the interests of the State by a rigid system of government regulation and audit. And lastly, coming to the conclusion that the small companies were weak and costly, he amalgamated them into six great companies, each with a large and distinct territory, and able, by their magnitude, to inspire confidence in the public, and aid the Government in the construction of fresh railways. This vigorous policy was very soon successful. Capital flowed in readily, construction proceeded with rapidity, and between the end of 1851 and 1857 the length of the railways opened was increased from 2124 miles to 4475 miles, or more than doubled. England at the same time had opened 9037 miles.

The laws and regulations affecting railway administration in France are scattered throughout many volumes, and form a very large mass of literature. They are all, however, founded on two early sets of laws—the first dated the 15th July 1845, and the second the 15th November 1846. The latter, which is the more important and comprehensive, deals with—

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(1.) The stations and the permanent way.
(2.) The materials of construction.
(3.) The composition of the trains.
(4.) The number, despatch, and arrival of trains.
(5.) Rates and fares.
(6.) Inspection and surveillance.[1]
(7.) Regulations for passengers, &c.
(8.) Sundry regulations.

Since the above laws were framed, however, they have been modified and varied in their scope by many succeeding enactments. There is, indeed, no country in the world where railway control has been more completely developed into a system of State interference than in France. The result is scarcely satisfactory to those who have had opportunities of comparing it with what is achieved under the freer and more democratic systems of England and the United States.

GERMANY.

In Prussia, under the law of the 3rd November 1838, every company proposing to lay down a railway required to apply to the Council of Trade, with particulars of the projected line, and the amount of capital proposed to be raised. The line of road, in its entire course, was to be subject to the approval of the Council of Trade, as well as the conditions of construction and the vehicles to be employed.

The authority of Parliament was required for the issue of more shares than the number originally fixed, as well

[1] In France, the Minister of Public Works appoints the members of a corps of commissioners and sub-commissioners, whose duty it is to see that the regulations made for the administration of the railways are properly carried out. In 1856 these officials numbered thirty, of whom six resided in Paris, two in Lyons, and one in each of the other large towns. Their annual emoluments amounted to a total of 110,000 fr. (about £146 each).—"Bulletin des Lois de la Republic Française," No. 240, 1850.

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as the raising of loans, which required to be coupled with the condition that a fund should be set aside for defraying the interest and redeeming the loan.

With reference to the acquisition of the land necessary for a new line, the company could purchase it without the consent of the authorities, but such consent was necessary to its re-sale. If the company failed to agree with the owners of land, the company had the right to appropriation, subject to the consent of the authorities, who named the appraisers and conducted the valuation in the presence of both parties. If dissatisfied with the verdict thus obtained, the owner of the land could obtain a judicial verdict on the question of value; but the railway company had no such privilege.

The Prussian Government, under section 42 of the General Railway Code of 1838, reserved the right of purchasing the property of the railway companies, on making compensation, under the following terms:—

(1.) The relinquishment cannot be demanded before the expiration of thirty years from the opening of the railway.

(2.) It could only be required to take place when a new settlement of the road tolls would have to be made.

(3.) The intention to require the surrender of the railway must be notified to the company at least one year before the period appointed for such surrender.

(4.) The Government to pay compensation to the company at the rate of twenty-five times the amount of the annual dividends which have been paid to the shareholders on an average of the previous five years.

On the 1st January 1871, a set of police regulations applicable to all the railways in the North German Con-

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federation came into force in that country. The regulations are classified under seventy-nine sections, and embrace the following heads:[1]—

(1.) Condition and control of the line.
(2.) State of the rolling stock.
(3.) Rules and arrangements for working the traffic.
(4.) Regulations affecting the general public.
(5.) Police.
(6.) Supervision generally.

A railway company is bound to keep its line and rolling stock at all times in good condition, and any failure to do so may lead to interference by the legally constituted authorities.[2]

A new set of regulations applicable to the whole railway system of Germany came into operation during the year 1886.[3] This code is most comprehensive, and is well worthy the close study of railway authorities in all parts of the world. It deals with every possible phase of railway construction and control—perhaps, if anything, with too great minuteness—but it is, at any rate, entitled to consideration as the crystallised embodiment of a long and a varied experience on the part of the State. We can only say here, in general terms, that the more important subjects dealt with include the condition of the permanent way; the provisions requisite for bridges, crossings, signals, &c.; the construction of the locomotives; the testing of locomotives and tenders; the construction of the rolling stock, with specific regulations as regards wheels, tyres, axles, &c.; the periodical examination of locomotives, carriages, and waggons; the weight and working of both goods and passenger trains; the rate of speed for different descriptions of traffic; the arrival and departure of trains; the conditions of working express and slow traffic; the

[1] "Collection of Laws for the German Confederation for 1870," No. 24.
[2] "Prussian Collection of Laws for 1838," sec. 29.
[3] Approved by the Minister of Public Works, 5th January 1886.

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transport of passengers by goods, and of goods by passenger trains; communication between passengers and guards; the character of electric communication; rules for working the signals; and many others that we cannot stay to enumerate. The regulations are classified under the four following principal headings:—

(1.) State and maintenance of the permanent way.
(2.) Condition and revision of the rolling stock.
(3.) Working the traffic.
(4.) Regulations affecting the public.

There is perhaps no system of State-aided and State-regulated railways that has been initiated and managed with more prudence than that of Germany.

In all agreements for assistance or concessions to private companies, the State has made stipulations with a view to the advantage of the general public in reference to the fixing of low tariffs, the construction of branch lines or feeders, the acquisition in certain cases of the management, the reservation of the right to repurchase the lines in certain contingencies at an earlier date than that fixed by the general law, and the recouping of the State for its expenditure under guarantees.

With a view to promote branch lines as feeders to main trunk lines, the State has in some cases given a free grant of part of the mileage cost. In other cases it has been made a preliminary to a concession for a proposed new line that the district should itself either furnish the land, or sufficient funds to buy it free of cost to the company.

AUSTRIA-HUNGARY.

In Austria the concessions for railway lines are granted for a fixed period not exceeding ninety years, at the end of which time the whole of the property in land, lines, and buildings reverts to the State without any payment whatsoever. Not only so, but the railway company is bound

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to hand over the property in good repair and in working order. The rolling stock, &c., remains the property of the company. The concession is, however, forfeited if, without grounds approved by the State, the completion and opening of the railway is delayed beyond the date fixed in the concession. Of £65,000,000 invested in Austrian railways to the end of 1866, the State had guaranteed interest at the rate of 5 per cent. on £50,000,000, with the view of stimulating the investment of capital in railway enterprise.

The Minister of Commerce is empowered to revise the tariff of charges on each line once in every three years. If the net profits of any company exceed 15 per cent., the Government can make such reductions in the tolls authorised by the concessions as will bring them within that limit.

BELGIUM.

According to the law in force in Belgium, the land necessary for the formation of railways has been acquired in pursuance of royal decrees, which direct the compulsory sale of such land for the public good.

In consequence of these decrees, the Government has placed itself in communication with the owners of the land, of which it has taken possession in legal form in those cases in which the Government and the owners have been agreed as to the price and condition of sale. But when there has been disagreement on these points,—that is to say, when claims believed to be exorbitant have been put forward,—the matter in dispute has been settled by the courts of law.

Some lands have been ceded to the Government gratuitously.

So far as regards the land on which the railway itself is constructed, the basis on which the offers of payment to the owners have usually been founded has been the prices obtained by public sale at the nearest date for the neigh-

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bouring land under analogous conditions. In default of these means of valuation, reference has been made, by mutual consent, to skilled arbitrators or valuers, whose valuation could be relied upon as representing the market value of the land.

It has frequently happened that various considerations have tended to enhance the claims of landowners, such, for instance, as the depreciation in the value of the land remaining after the compulsory sale of so much as was required for the construction of the railway, difficulties in cultivating pieces of land severed by the railway which previously were undivided, &c. In such cases the claims of the landowners have often been exorbitant, and reference has had to be made to the courts of law, which have given their decision after hearing the opinions of arbitrators or valuers appointed by themselves.

The Government has, as in most other countries, had to pay, besides the price of the land, compensation for the loss of crops, and of profits arising from manufacturing works, &c.

It has been the custom in Belgium for the State to grant a lease to private companies for ninety years, at the end of which time the lines revert to the State, or to construct the railways at the public expense. In the former case, the leases specify that the land required for the construction of the railway and its accessories shall be acquired in the name of the State. In point of fact, although there are nominally three different systems of railway control and proprietary,—that of railways constructed and worked by the State, that of lines constructed by private companies but worked by the State, and that of railways constructed and worked by private companies,—the three systems are virtually alike in this, that the lines are fundamentally the property of the State, since, even in the case of private companies' lines, the State only surrenders for a time the profit of the railways, on the condition that they are properly maintained and worked.

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The lessees of a railway in Belgium are bound, before commencing any part of their line, to submit to the Government their working regulations, embracing all the orders and arrangements necessary for the safe and efficient conduct of the traffic. These regulations, after approval or modification by the Government, are strictly binding on the company.

If a company should fail, within a reasonable time of the opening of a line, to undertake its working, the Government is empowered to step in and work the line on the company's behalf, making use for that purpose of the rolling stock, &c., just as if all belonged to the State. If, after three months of such provisional official working, the receipts do not amount to a certain specified limit, the company is deprived of all its rights.

The control of the State railways in Belgium is vested in a Council of Central Administration, with the Minister of Public Works as president, the Director-General of Railways as vice-president, and the six inspectors-general as members. This Council advises the Minister of Public Works on all matters that he may have to submit for consideration.

Italy.

In Italy, the Government exercises control over all railways, under the authority of the Department of Public Works, by commissioners, who, as the immediate representatives of the State, are required to correspond directly with the Public Works Department, and with the prefects of the provinces traversed by the lines under their supervision, whose decisions they are bound to notify to the companies. The commissary is also required to watch over the persons employed, and to see that the railway and everything belonging to it is always in good working order. He must, moreover, make a general inspection of the line and works every three months, and address to the Public Works Department a detailed report thereupon.

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It is also the duty of this official to make inquiries into railway accidents, and furnish reports thereon to the Government.

Under the Public Works Law of 1865 it is provided that in Italy, on the completion of a railway, the Ministry of Public Works shall cause a general inspection thereof to be made, for the purpose of ascertaining whether all the requirements of the law and conditions of the concession have been fulfilled, with regard principally to those intended to ensure public safety and the efficient and permanent working of the line. If there appear any defects, and the persons having the concession fail to remedy them when required to do so, the Government is, by the same article, empowered to execute the necessary works, and to employ for that purpose any portion of the deposit still held by it, or, should such means prove insufficient, to repay itself out of the first receipts of the railway.

By Article 268 the Department of Public Works may at any time order additions to be made to the rolling stock, or changes to be introduced into it, provide for its examination, and order the disuse of such vehicles as are judged to be dangerous or unfit for service.

Article 282 empowers the Government to regulate time-tables.

By Article 289, holders of railway concessions are subjected not only to regulations issued in execution of the law, but also to such special rules as may be prescribed for the police, and the maintenance and regular working of the railways.

Article 317 provides that all that relates to the police, to the security and the regular working of railways, to the particular rules to be followed with regard to the establishment and preservation of a railway and its dependencies, to the supply, employment, and keeping in repair of the rolling stock, to the composition, departure, arrival and running of trains, and to the supervision

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(*sorveglianza*) of the working of the line, &c., shall be laid down by royal decree; and further, that breach of such regulations may entail penalties and fines, to an amount not exceeding 1000 francs in any one case.

In 1881, a report was presented by a Special Commission appointed by the Italian Government to inquire into the relations between the railways and the State. They did not encourage the principle of State control. Under contracts made in 1885, the State ceded the control of the railways to two great companies for sixty years—each party having, however, the right to retire at the end of twenty or forty years. The companies buy at a valuation the rolling stock now owned by the State, and keep it in repair at their own charge as part of the ordinary operating expenses. The receipts are divided between the railways and the State in definite proportions. It is provided that as soon as the gross returns of either company shall be two millions sterling, or thereabouts, over the assumed minimum, it shall only receive about fifty per cent. of any further increase, while six per cent. shall be applied to such reductions of rates as the State may prescribe. Again, the State reserves the right to share to the extent of one-half in dividends exceeding 7½ per cent. In this case, therefore, the State has practically abdicated direct control over the railways—subject to certain reservations and gaurantees—in favour of private companies.

HOLLAND.

The King of Holland, William I., convinced of the great importance of a railway connection between the Dutch seaports and Germany, proposed in 1837 to the Chambers to build such a railway on behalf of the State, beginning with a branch from Amsterdam to Arnheim.

This proposal not having been approved of, the King issued, in 1838, a decree by which he opened a loan to the amount of 900,000,000 florins, at 4½ per cent. interest

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per annum, guaranteed on his personal estate. The produce of this loan was to be used for the construction of a railway from Amsterdam to Arnheim, whilst his Majesty reserved to himself the power to increase this loan subsequently, in order to obtain the necessary funds for a junction from Rotterdam to Utrecht. The loan was to be redeemed out of the profits of the undertaking, whilst, after the whole loan had been paid off, the railway with all its dependencies was to become the property of the State.

The first years of the undertaking having yielded very unsuccessful results, King William II. resolved to give up the whole undertaking to the Dutch-Rhenish Railway Company, which meanwhile had been formed, in consideration of the said company taking over all the obligations of the above-named King's loan. The company was to be at liberty to supply the funds eventually required for the redemption of the loan out of their own capital, but, on the other hand, the Government was to be bound to refund to the company all amounts whatsoever spent by it, either for construction, for improvement, or for redemption, before the State could again take over the undertaking from the company.

The State railways in Holland have been constructed by the Government entirely with public money. The working of the State railways has, however, been entrusted to a private company.

As the State railways are a Government undertaking, the necessary funds were unconditionally provided.

The capital spent on the construction of the State railways in Holland is considered as the permanent property of the State. So far as the State will participate in the net proceeds of the working, the public revenues will obviously be benefited.

The State does not run any risk of loss in consequence of the working of the State lines, as such risk has been thrown entirely on the company that has undertaken the

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working of the State railways and the Dutch company already referred to. The net profits are divided between the Government and the companies, according to a scale to which both are contracting parties.

Russia.

Russia is furnished with a larger proportion of private or companies' lines than almost any other European country. Out of a total of 19,348 kilometres of railway open in 1883, no less than 18,298 kilometres were the property of private concerns, leaving only 1050 kilometres owned and exploited by the State.

The provisions made with a view to securing the proper construction and working of Russian lines are not greatly different to those that are enacted in other European countries. Concessions are granted by the Government for the building of projected lines for a certain term of years, at the end of which period the lines revert to the State. There is a railway department carried on as a Governmental bureau, in which the regulations and enactments under which Russian railways are administered are framed.

We have now seen that in all the leading countries of Europe alike, the necessity of exercising more or less control over railways has been appreciated and provided for. In the United Kingdom the control so exercised is probably less strict—it is assuredly less irksome and inquisitorial—than in most other countries. The supervision exercised by the Board of Trade in England applies mainly to seeing that the permanent way is in good order before being opened, that adequate provision is made against the occurrence of accidents, and that when accidents unhappily do occur, in spite of all precautions to the contrary, they shall be fully and fairly inquired into. But on the Continent, State control, over even private lines, generally goes a great deal further than

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this. The commissioners, inspectors, superintendents, police authorities, and others charged with the duty of keeping railway companies up to their duty, and enforcing compliance with the laws relative thereto, are continually pursuing their inquisitorial functions, watching over the persons in charge of the several departments, making frequent inspections of the permanent way and works, drawing up reports on defects of working or breaches of the law; and they are even authorised in some cases to call meetings of boards of directors, and in others to stop a railway that does not appear to them to have adequate provision for the safety of those who use or are employed on it.

We have also seen that the railways of England occupy almost an unique position, so far as Europe is concerned—so much so as almost still to justify the criticism made exactly forty years ago, that this is "the only country in the world whose Legislature has committed the singular imprudence of surrendering, without available conditions, and for an indefinite time, its public communications into private hands."[1] Has the evil become too deep-seated to be incapable of remedy? If not, how and from what source is the remedy to be applied? We shall consider this point more fully when we come to deal with some allied questions.

[1] *Edinburgh Review*, October 1846, p. 529.

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CHAPTER VII.

GROSS AND NET EARNINGS.

THERE is a remarkable variation in the proportions of gross and net revenue which are earned by different railways. To account for this fact adequately would involve an exhaustive examination of all the conditions under which each individual railway is carried on. The gross earnings of a railway are, of course, the total amount of revenue received from all sources, without any deductions whatsoever. The net earnings are the receipts that are left as profit, or for disposal otherwise, after the working expenditure has been deducted. It is manifest that the gross receipts will be large or small according as the traffic is heavy or light, and that the net receipts will be mainly a function of the working expenditure. There are, however, no two railways that are precisely on the same lines in reference to either item, and the differences that obtain in reference to both are such as to make a really capable and trustworthy analysis of this subject one of the most difficult and complicated in the whole domain of railway economics.

The Gross Earning Power of Railway Capital.—The capacity which railway capital shows for earning a large gross percentage upon its amount, is in some cases a fair criterion of the character of the investment. It is not, however, always to be regarded in this light, since the conditions of no two railways are exactly alike; and it is easily possible to conceive, and even to cite examples, of lines that ought, theoretically, to show a large earning

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capacity when they really have a small one, and conversely, it is no rare thing to find an entirely different state of affairs.

If the percentage proportion of the gross income required for the working expenses of a railway—the "co-efficient of exploitation," as it is called on the Continent—were in all cases the same, there could be no truer test of the value of any railway as an investment than the gross earning power of the capital embarked. But it so happens that the theoretical requirement here laid down is never really attained in practice.

The tendency of the gross earning capacity of British railways has been in the direction of decline during the past few years. This is apparently the result, not of diminished gross earnings, but of the enormous increase of capital expenditure, as the following figures show:—

Statement showing the Increased Mileage, the Increase of Capital, and the Increase of Mileage and Capital relatively to the Gross Income of Railways in the United Kingdom in each Year from 1870.

Years.	Increase of Mileage.	Increase of Capital (£1 = 1000).	Average Additional Capital per Mile Added (£1 = 1000).	Gross Receipts of Railways in the United Kingdom (£1 = 1000).	Percentage of Gross Receipts on Capital.	Total Capital (£1 = 1000).
					per cent.	
1873	268	£19,273	£71,914	£55,675	9	£588,320
1874	367	21,575	58,787	56,899	9	609,895
1875	209	20,328	97,263	58,982	9	630,223
1876	214	27,991	130,799	59,917	9	658,214
1877	205	15,845	77,293	60,644	9	674,059
1878	256	24,486	95,648	60,454	9	698,545
1879	363	18,458	50,848	59,395	8	717,003
1880	237	11,314	47,738	62,961	9	728,316
1881	242	17,211	71,120	64,493	9	745,528
1882	282	22,372	79,333	66,537	9	767,899
1883	224	17,021	75,986	68,210	9	784,921
1884	183	16,543	90,399	67,701	8	801,464

The facts that appear to be most prominent in this statement are:—

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(1.) That as against an increase of only 2782 miles in the length of line opened, there has been an increase in the capital expenditure of 213 millions, or an average of about £77,000 per mile added.

(2.) That the effect of this enormous increase of capital has been to raise the average capital per mile open from £36,574 in 1873 to £42,486 in 1884.

(3.) That the gross earning power of capital has thereby been kept down, notwithstanding a considerably larger average revenue per mile of line open.

At the present time the gross earning power of capital in the United Kingdom is lower than in any of the principal countries of Europe, the character of whose railways is most in common with our own. This fact is clearly brought out in the following statement, which shows that, after Sweden, railway capital has the highest gross earnings in the United States, and the next highest in Germany, while France and Belgium occupy the third and fourth places respectively:—

Statement showing the Gross Earning Power of Railway Capital in Different Countries in 1883.

Countries.	Total Capital Invested in Railways (£1 = 1000).	Gross Receipts from Railways in 1883 (£1 = 1000).	Percentage of Gross Receipts on Capital Invested.
Germany	£462,636	£48,494	10.4
France	459,278	45,021	9.8
Belgium	68,817	6,479	9.4
Holland	26,202	1,998	7.6
Austria-Hungary	263,333	23,080	8.7
Italy	114,092	8,245	7.2
Switzerland	38,042	3,083	8.1
Norway	6,900	372	5.4
Sweden	12,209	2,169	17.7
Denmark	7,614	726	9.5
Canada	83,122	6,684	8.0
United States	1,499,094	164,754	10.9
United Kingdom (1884)	801,464	70,522	8.8
Totals and averages	3,842,803	381,627	9.9

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It is necessary to bear in mind, in considering this subject, that the gross earning power of capital, although a function both of the average capital expenditure per mile open and of the quantity of traffic brought on to a line, may be affected very largely by either consideration, without reference to the other. Thus, we find that, in the United Kingdom, the average gross receipts per mile open are very much higher than in the United States or Germany, so that if this fact alone were to be the determinant of gross earning capacity, English railways would be far superior to any others. But as the capital expenditure on English railways is also greatly above that incurred in other countries, the result is as we have stated.

Perhaps it would be impossible to illustrate this fact more clearly than by comparing the conditions, as regards capital and gross earnings, of the Pennsylvania and the London and North-Western Railways. On the Pennsylvania Railway the average capital expenditure per mile has been £26,360. On the London and North-Western Railway it has been £55,078. The gross earnings per mile open on the Pennsylvania Railway have been £4880; on the London and North-Western Railway they were £6000. The result of these differences has been that the gross earning power of capital on the Pennsylvania Railway is 26 per cent., as against only 10.7 per cent. on the London and North-Western Railway. But if the average capital expenditure per mile on both lines had been the same, the London and North-Western Railway would obviously have shown a much better result than the Pennsylvania Company.

It is not necessary that the subject of the greater average cost of English lines should be examined here. The subject is referred to elsewhere at some length, and we need only remark now, in general terms, that the enormous difference in capital cost, as against English lines, must always tend to prevent any substantial improvement in their gross earning capacity, although it is not unlikely

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that the net earnings may be increased by a greater regard to economy of working. Should this be the case, the position of English railways as investments need not necessarily be worse than that of countries in which the gross earning power of capital takes a greatly higher range.

It is also to be remarked that the tendency towards a lower gross earning capacity of railway capital is not peculiar to England. In the United States there has, within a few years, been a reduction from 15 to about 10 per cent., and in Belgium, as the following table shows, the reduced gross earnings of capital since 1880 have not been accompanied by any corresponding reduction in the percentage of net receipts on capital expenditure:—

Statement showing the Cost of Construction and Gross and Net Receipts from Railway Working in Belgium, 1876–84.

Years.	Total Cost of Construction (£1 = 1000.)	Percentage of Gross Receipts on Cost of Construction.	Gross Receipts (£1 = 1000).	Net Receipts (£1 = 1000).	Working Expenses (£1 = 1000).	Percentage of Net Receipts on Capital.
1876	£53,720	9.6	£5,173	£1,958	£3,215	3.6
1877	55,828	9.2	5,137	2,048	3,089	3.7
1878	55,553	9.6	5,308	2,210	3,098	4.0
1879	59,920	9.1	5,470	2,266	3,204	3.7
1880	62,294	9.7	6,858	2,470	3,588	3.9
1881	63,504	9.6	6,078	2,401	3,677	3.7
1882	66,385	9.6	6,355	2,525	3,830	3.8
1883	67,877	9.5	6,480	2,666	3,814	3.9
1884	68,817	9.2	6,359	2,661	3,698	3.8

Net Earning Power of Railway Capital.—The net revenue from railway working is, as we have already indicated, the revenue that remains for the payment of interest on capital, and the distribution of profits, after the deduction of the working expenditure from the gross receipts. This subject having already been considered in treating of railways as investments, the briefest reference to it here may suffice.

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In the United States there has been an interesting controversy as to what is the proper meaning of the term "net earnings." The chief parties to the dispute have been the Government on the one hand and the Union Pacific Railroad Company on the other. The terms upon which the former advanced money to the latter for building their lines provided that a certain proportion of the net earnings of each year should be paid over to the Government, and that the net earnings "shall be ascertained by deducting from the gross amount of the earnings the necessary expenses actually paid within the year in operating the same and keeping the same in a state of repair, and also the sum paid within the year in discharge of interest on their first mortgage bonds, whose lien has priority on the lien of the United States." In one case where this point was brought to the test of a legal judgment, it was held that "net earnings, within the meaning of the law, are ascertained by deducting from the gross earnings all the ordinary expenses of organisation and of operating the road, and expenditures made *bonâ fide* in improvements, and paid out of earnings, and not by the issue of bonds or stocks." In another case, the Court held that "in ascertaining net earnings there should be deducted from gross receipts the equipment account, or replacing and rebuilding of rolling stock, machinery, &c., the amounts paid for depôt grounds, and the expenses of the same, and the construction account, or improvements and additions to the track." The United States Government, however, maintained that outlay for new construction and new equipment was not "necessary expenses actually incurred within the year" in keeping up and operating the line, and declined to settle upon any basis which deducts such items from gross receipts in ascertaining net earnings.

It appears to be not a little remarkable that, notwithstanding the enormous increase in the volume and value of the traffic on English railways within the last twenty years, and the considerable reduction of working expenses

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as regards most of the principal items that have elsewhere been shown to occur over the latter half of that period, the average percentage proportion of net earnings to the total paid-up capital has varied but little as between one year and another since 1860. During the whole period that has since elapsed the average of such percentage has never risen to 5 per cent., and has only in three years been below 4 per cent., the average for 1860 being practically identical with 1884, and this in spite of the fact that in 1860 the net receipts per mile open were £1400, and in 1884 amounted to £1800 per mile. This fact argues that there has in the interval been an enormous increase of unproductive capital expenditure, which is vividly reflected in the increase of capital per mile of line open—this item being represented by £33,368 in 1860, and £42,486 in 1884. The question may well be asked, What is there to show for this difference? There has been, as we shall presently see, a great increase of net receipts per mile open, but that net increase would have accrued, as it has in other countries in which there has been no addition to average mileage expenditure, in any case.

The net receipts of a railway are regarded in several different aspects, each one of which is calculated to throw its own light on the questions that cluster around this problem. They may be looked at either from the train-mile point of view, or they may be considered in reference to the mileage open, or, finally, they may be examined in reference to the dividends which they represent on the capital invested.

In most countries the net receipts have not grown so quickly nor so largely as the gross. This is attributable to the increase that has taken place in working expenditure. Great Britain, however, does not come into this category. Of the total gross receipts in 1884, only 53 per cent. were required for working expenditure, as compared with 55.6 in 1874. The largest increase took place in

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Scotland, where only 52.1 of the total gross receipts were required for working expenses in 1884, as compared with 56.8 per cent. in 1874. In England and Wales, considered separately, the diminution was from 55.4 to 53 per cent.; and in Ireland it was from 57.0 per cent. to 56.2 per cent., or the least of the three.

The Board of Trade returns set forth the gross receipts per train mile from railway working in the United Kingdom as a whole. This information is continued from year to year in a most useful summary table, whence we have borrowed figures, quoted elsewhere, that show a very substantial increase in the gross income. The increase between 1874 and 1884 was £130 per mile open, or about 4 per cent. During the same interval the net receipts from railway working which are not—as we think they ought to be—so specifically set forth in the Board of Trade returns, increased from £1535 to £1685, being an increase of £150 per mile of open line, or over 9 per cent. It is, therefore, apparent that the improvement during this interval has been more marked in the net than in the gross receipts, as tested by the average per open mile; and this result quite corresponds with what we have elsewhere stated as to the economy of working that has taken place over the same period in nearly every department.

The total net receipts and the net receipts per mile open on the railways of the United Kingdom have, over the eleven years ending 1884, been as follows:—

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Statement showing the Net Receipts from Railway Working and the Net Receipts per Mile Open in the United Kingdom, 1874–1884.

Year.	Total Net Receipts (£1=1000).	Mileage Open.	Net Receipts per Train Mile.
1874	£25,252	£16,449	£1,535
1875	26,784	16,658	1,608
1876	27,445	16,872	1,632
1877	27,823	17,077	1,629
1878	28,309	17,333	1,633
1879	28,345	17,696	1,601
1880	30,464	17,933	1,698
1881	30,792	18,175	1,695
1882	31,637	18,457	1,660
1883	32,166	18,681	1,711
1884	31,789	18,864	1,685

In Continental countries the percentage of the total gross receipts required to work the traffic varies very greatly, as we shall see in the next chapter. It is not necessary to reproduce the figures there given, which afford all the light that is necessary to enable a just estimate to be formed of the circumstances of the different countries in this regard.

With a view to showing the net receipts per kilometre constructed, we have collated the following tabular statement from the official records of European countries. It appears that the highest net receipts, measured by this standard, are obtained in France, the next highest in Austria, the next in Germany, the next in Belgium, and the next in Russia.

These figures do not, however, necessarily correspond with the highest percentage of profit on the capital invested, which is a function of the capital expenditure equally with the net receipts. As a matter of fact, the highest percentage of net receipts on the cost of construction is almost in an inverse order to that of average net receipts per kilometre, Russia coming first with 4.75 per cent.; Germany next, with 4.68 per cent.; France next,

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with 4.63 per cent.; Belgium next, with 4.03; and Austria last, with 3.98.

Statement showing the Total Receipts and Expenses of European Railways in 1883.

Countries.	Receipts (1 fr. = 1000).	Working Expenses (1 fr. = 1000).	Working Expenses per Kilometre (Francs).	Net Receipts (1 fr. = 1000).	Net Receipts per Kilometre (Francs).
Germany . .	1,154,769	604,915	17,341	549,933	15,764
Austro-Hungary	589,845	285,204	15,241	305,495	16,268
Belgium . .	136,907	83,779	22,796	53,126	14,457
Denmark . .	16,352	12,354	7,771	3,998	2,526
France . .	1,115,957	580,615	20,805	535,342	19,183
Italy . . .	193,409	132,836	14,772	60,574	6,737
Luxembourg .	2,590	1,605	10,771	985	6,611
Norway . .	8,233	5,494	4,353	2,739	2,171
Holland . .	51,099	28,365	14,532	22,733	11,646
Roumania . .	23,130	14,447	11,001	8,682	6,614
Russia . .	860,651	574,118	25,165	286,533	12,561
Finland . .	7,917	4,743	5,700	3,174	3,815
Switzerland .	67,084	32,398	11,808	34,686	12,640
Totals and average	4,227,943	2,350,873	182,056	1,868,000	10,076

Among foreign countries out of Europe there are equally great variations in the proportions of net to gross receipts. The best results, curiously enough, appear to be obtained in Egypt, where more than 60 per cent. of the gross receipts were available for profits. Japan is also one of the most successful countries in this respect, showing in 1883 a net product of 47.50 per cent. Among other countries the results of working in 1883 were as under:—

In Brazil . . .	58.50	per cent. of gross receipts were absorbed in working.
„ Canada . . .	76.00	„ „
„ Algeria . . .	75.90	„ „
„ British India . .	48.50	„ „
„ New South Wales .	54.00	„ „
„ New Zealand . .	68.00	„ „
„ Victoria . .	67.00	„ „
„ Queensland . .	49.00	„ „

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It has been calculated by a high French authority that, taking all the countries of the world together, the percentage proportion of the gross receipts from railways required for working expenditure is 62 per cent., which means that the average net receipts would amount to 38 per cent. of the whole. In the United Kingdom, where the net receipts are 47.4 per cent. of the whole, the average result is thus superior to that of railway working generally.

Traffic managers are accustomed to point to the fact that the average receipts per train mile have diminished within recent years, as an evidence that they have been within late years working for less profit and at reduced rates of freight. This most probably is the case, but the fact that the average receipts per train mile have fallen from 5s. 6½d. in 1854 to 5s. in 1884 is not a necessary nor irrefragable proof of such a circumstance. The same result would have occurred with the same rates of freight if either of two other things had happened, viz.—

(1.) A reduction in the average weight of the trains as measured by the number of waggons; or

(2.) A reduction in the average weight carried per waggon.

And there is some reason for supposing that the railway companies do not now provide for securing such full train loads as they did at an earlier stage of their operations. Be that, however, as it may, the average receipts per train mile were slightly higher in 1866 than they are at the present time.

The Duke of Devonshire's Commission of 1867 gave some interesting examples of the average receipts per train mile in different countries, the more important being—

For United Kingdom	. . .	5/1.74	per train mile.
„ France (Nord)	. . .	7/4	„ „
„ „ (Ouest)	. . .	7/11	„ „
„ Belgium	. . .	6/3	„ „
„ Prussia	. . .	5/9	„ „
„ Austria	. . .	5/4	„ „

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The Commission, arguing that the higher the receipts per train mile the fewer the number of trains in proportion to the amount of traffic carried, and *vice versâ*, concluded on these facts that the accommodation provided in Great Britain was greater than on the Continent of Europe. This is no doubt the fact, to a certain extent; but it should never be forgotten that the average receipts per train mile are liable to be as much affected by the range of the rates and fares charged as by the quantity of traffic carried.

In the next table we have compiled a statement of the gross traffic earnings, in relation to the train miles run for the principal countries of the world. The statement is of importance as showing that in the United States and in Germany, where the range of rates and fares is lower than in England, the receipts per train mile are higher, owing, no doubt, to the greater loads carried:—

Statement showing the Gross Earnings of Railways in Different Countries, the Number of Train Miles run, and the Average Earnings per Train Mile in 1883.

Countries.	Total Train Miles (1 = 1000).	Gross Traffic Earnings (£1 = 1000).	Average Earnings per Train Mile.
		£	s.
Belgium	30,693	6,479	4.22
Germany	141,597	48,494	6.85
France	162,722	45,021	5.53
Switzerland	9,523	3,083	6.66
Italy	35,707	8,245	4.62
Norway	2,007	372	3.71
Sweden	8,804	2,169	4.93
Denmark	3,503	726	4.14
Canada	29,758	6,684	4.49
United States	389,247	171,619	8.00
United Kingdom	272,803	70,522	5.17
Totals and average	1,086,364	363,414	6.7

It does not seem as if the above figures required

pass. tr. mileage = 194 miles
1st " " = 350 "
544 tr. m. gross = 824 tons

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any specific explanations or comments here. They are, moreover, more fully illustrated and analysed in the chapters that deal with railway expenditure in its several branches, and with the working of goods and passenger traffic.

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CHAPTER VIII.

WORKING EXPENSES.

FROM a commercial point of view, a railway enterprise naturally divides itself into three separate heads, viz. (1) the first cost; (2) the gross receipts; and (3) the working expenses. Given these three items, and the character of the railway as an investment may readily be determined. The working expenses, however, show more than this. They afford a clue, in their details, to the comparative economy or extravagance with which a railway is managed, to the sources of possible leakage, to the higher or lower comparative prices of materials and costs of labour, to the greater or less expense attending the various descriptions of traffic, and to other points that are of more or less importance in relation to the efficient administration of our transportation system.

Such being the case, it is obvious that in considering the many problems that are continually presented for settlement in relation to railway control, the expenses of working the systems possessed by different countries are entitled to a foremost degree of attention, being, in point of fact, next to gross receipts, the determining factor alike of rates, fares, profits, and efficient service.

The subject of railway working expenses may be considered from many different points of view. They may be regarded with reference to the gross earnings, with reference to the train mileage, with reference to the amount of traffic, and with reference to the capital expen-

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diture. Then, again, they may be examined in relation to the several subjects under which they naturally divide themselves, such as—

1. Maintenance of way.
2. Locomotive charges.
3. Repairs of rolling-stock.
4. Traffic charges.
5. Compensation, taxation, &c.

With reference to some of the more important of the items specified, we have written at some length in subsequent chapters. The general bearings of the whole subject we propose to consider here.

It is manifest, *ab initio*, that the cost of working a railway, and especially of working a whole national system, will be affected by the extent and consequent cost of its administration, in relation to the mileage which it controls, and the area of its operations otherwise.

There is no phase of railway administration that is of greater importance in its ultimate effects on economical working than that of having as few boards of direction as possible. A great deal has been done within recent years, by the amalgamation of smaller with larger lines, to reduce the cost of management to the narrowest limits.

In 1843 the 2100 miles of railway open in Great Britain were owned by seventy companies, giving an average mileage of 30 miles to each company. In 1865, however, there were 11,451 miles of railway under the control of seventy-eight companies, giving an average of about 150 miles to each. In the special case of Ireland, there were seventeen companies controlling 1838 miles, being an average of 108 miles per company.

In 1884 the position of the railway system of the United Kingdom stood as follows:—

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Countries.	Number of Companies.	Total Mileage.	Average Miles to Each Company.
England and Wales . .	94	13,340	142
Scotland	8	2,999	375
Ireland	23	2,525	109
Totals and average .	125	18,864	151

It would therefore appear that the average number of miles of railway to each separate administration is greatest in the case of Scotland, and least in the case of Ireland. This circumstance is coincident with the generally superior economical results obtained in the case of the Scotch lines. There are, indeed, few countries where economy of administration has been carried to such perfection as in Scotland, and there are few nations that have a better idea of what is necessary and desirable to "save the bawbees"—the one fact being indeed the inevitable complement of the other. In Ireland, on the other hand, where seventeen railways have each less than 100 miles of length, there would seem to be a much greater administrative expenditure, which may, again, be accepted as a reflex of the average Irish character. Thus, although it would not probably be to railway control that one would naturally look if asked for a sufficient example of the psychological and economic tendencies of different peoples, we are yet furnished with one of the most typical and convincing proofs of the differences in national idiosyncrasies in the facts to which attention has just been directed.

Of the ninety-four separate railway administrations in England and Wales, seventy-two controlled less than 30 miles each, and six controlled about 9000 miles, or, roughly, 50 per cent. of the entire railway system of the United Kingdom, and about 70 per cent. of the entire railway system of England and Wales.

On the Continent of Europe the number of separate

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railway administrations, relatively to the mileage of lines open, appears to be less than in the United Kingdom. The following statement will show how the principal European countries compare in this regard:—

Table showing the Mileage of Railways Open in Different Continental Countries, and the Number of Separate Administrations relatively thereto.

Countries.	Mileage Open.	Number of Administrations or Companies.	Average Miles per Administration.
Germany	21,785	49	445
Austria	12,603	64	197
Belgium	1,885	4	471
Denmark	926	2	463
France	16,578	117	142
Italy	5,871	12	489
Luxembourg . . .	94	1	94
Norway	970	10	97
Holland	1,406	5	281
Russia	14,226	50	285
Finland	638	3	213
Switzerland . . .	1,795	17	106
Totals and average .	78,777	334	236

In the United States the relation of miles of railway to the number of separate corporations, in the census year 1880, was as under for each group of States:—

States.	Total Miles of Railway.	Total Number of Corporations.	Average Miles per Corporation.
New England States .	5,887	132	45
Middle States (New York, &c.) . . .	28,692	458	63
Southern States . .	14,243	140	102
Western „ . .	25,037	160	156
Territories, &c. . .	876	12	73
Pacific States . . .	13,044	115	113
Totals . .	87,779	1,017	86

It appears from these figures that in the United States

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as a whole the principle of the subdivision of mileage under a large number of companies is carried further than in either England or Continental Europe. This feature of American railroad working would be still more marked were the half-dozen largest corporations withdrawn from the list, some of these controlling about 2000 miles each or upwards. It is, however, to be observed that in spite of this presumed disadvantage the American railway system has the lowest freight charges in the world, as well as, in some respects, the lowest working charges. The actual expenses incurred for salaries of general officers and clerks on American railroads generally amounted in 1880 to a little over three millions out of a total working expenditure of 88¼ millions, being 3.5 per cent. of the whole. Put in another way, the costs of management, as represented by salaries of general officers and clerks, were 2.2 per cent. of the gross transportation earnings.

On the Continent of Europe the railway authorities are accustomed to make a careful analysis of the different items that enter into the cost of working their several systems, corresponding to the classification already indicated. The different countries vary so considerably in reference to the average proportions of the whole working expenses, returned under the several headings of maintenance of way, locomotive charges, traffic charges, and administration, &c., as to suggest a doubt whether the figures supplied always apply to exactly the same particulars, and are expressed in exactly the same terms. Unless this were the case, it is obvious that any comparison of one country with another must be fallacious and misleading.

The relation of each separate item to the whole in the working expenditure of British lines has undergone very material modification during the last thirty years. Some items have largely, and, it almost appears, permanently increased. Others have been considerably reduced. The increase is chiefly conspicuous in rates and taxes, repairs

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and traffic charges. The reduction appears to have been most marked in locomotive charges, maintenance of way, compensation for injury to passengers and goods, and legal and Parliamentary expenses.

These variations are quite accordant with the economic changes that have been occurring during the interval. Maintenance of way is chiefly affected by the price of labour and materials. The former has not materially advanced within recent years, while that of the latter has largely decreased. Locomotive charges, again, are partly affected by the two considerations just named, and partly by the element of fuel, which latter, as we shall have more particularly to show later on, has considerably fallen in cost. The increase that has occurred in rates and taxes is readily accounted for by the enormous multiplication of local and imperial burdens generally, and that in traffic charges is to be explained by the restrictions imposed by Statute law with a view to public safety.

The following statement shows the percentage proportions which the different items of expenditure in the working of railways bore to each other in the years 1842, 1865, and 1884:—

Statement showing the percentage proportions of Working Expenditure on the Railways of the United Kingdom.

Items.	1842.	1865.	1884.
	Per cent.	Per cent.	Per cent.
Maintenance of way	17.8	18.31	17.70
Locomotive charges	30.0	27.48	25.45
Repairs of carriages	31.3	8.83	9.14
Traffic charges		28.64	30.30
Rates and taxes	5.9	3.93	5.22
Government duty	10.0	2.63	1.07
Compensation for injury—			
To passengers	5.0	1.94	0.50
To goods		0.68	0.55
Legal and Parliamentary expenses		1.44	0.87
Miscellaneous expenses		6.12	9.11
Totals	100.0	100.0	100.0

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This table is very instructive. It shows that the cost of maintenance of way has not varied greatly as between the three periods tabulated, that locomotive charges have shown a tendency to decrease, and that the percentage of rates and taxes (including Government duty) has been increased.

The expenditure per train mile has also decreased considerably within recent years. In order to ascertain the precise effect of this economy on the working of the traffic, it would be necessary to ascertain precisely the conditions under which the traffic was worked, as regards receipts, and the quantities carried at different periods. It is not enough to state the fact that the total expenditure per train mile on the railways of the United Kingdom has fallen from 37.89d. in 1874 to 31.59d. in 1884. We must ascertain, at the same time, the standard to which this reduction of expenditure has reference.

That standard is generally held to be the average receipts per train mile, and per mile of railway open for traffic. In the average receipts per train mile there was a reduction between 1874 and 1884 from 68.11d. to 59.56d., being 8.55d. or 2.2d. more than the amount of the reduction effected within the same interval in the working expenses per train mile. In the receipts per mile of line open for traffic there was an increase from £3459 to £3589 between 1874 and 1884, so that, in reference to this test, there has been a real improvement. But the train mile test is, after all, the true one, and the reduction in the average receipts per mile run is not a healthy indication, seeing that, as we have elsewhere shown, it is undoubtedly largely attributable to the running of both goods and passenger trains less fully loaded than they should be.

The details of the working expenditure per train mile for each of the years 1874 and 1884 are recorded in the following table:—

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Statement showing the Expenditure per Train-Mile on the Railways of the United Kingdom in 1874 and 1884, with Amount and Percentage of Increase and Decrease in the latter Year.

Items.	Total Expenditure per Train-Mile in		Amount of Increase or Decrease in 1884.	Per Cent. Decrease — or Increase + in 1884.
	1874.	1884.		
	d.	*d.*	*d.*	
Maintenance of way . . .	7.85	5.82	− 2.03	− 26
Locomotive power . . .	10.80	8.35	− 2.45	− 23
Rolling-stock	3.06	3.00	− 0.06	− 2
Traffic expenses	10.83	9.91	− 0.92	− 8
General charges . . .	1.41	1.44	+ 0.03	+ 2.1
Rates and taxes . . .	1.42	1.70	+ 0.28	+ 19.0
Government duty . . .	0.75	0.37	− 0.38	− 51
Compensation—				
For personal injury . .	0.43	0.16	− 0.27	− 63
For damage to goods . .	0.30	0.18	− 0.12	− 40
Legal and Parliamentary expenses	0.38	0.29	− 0.09	− 24
Miscellaneous	0.69	0.41	− 0.28	− 41
Totals . . .	37.89	31.59	− 6.30	− 16

On all the pincipal railways, both English and Scotch, there has been a substantial decrease of working expenses, as between the years 1874 and 1884. The minimum decrease occurs in the case of the London and South-Western Railway, where it amounts to 11 per cent. The maximum decrease appears in the case of the South-Eastern, where it reaches 24 per cent. The variations that have occurred in the working expenditure per train-mile, as between these two periods, are shown in the next table for the chief British railways:—

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Statement showing the Working Expenditure per Train-Mile in 1874 and 1884 on British Railways.

Railways.	Total Expenditure per Train-Mile in		Amount of Decrease in 1884.	Per Cent. of Decrease in 1884.
	1874.	1884.		
	d.	d.	d.	
Caledonian	34.77	30.13	4.64	13
Great Eastern	39.31	30.62	8.69	22
Great Northern	35.67	28.12	7.55	21
Great Western	34.12	29.67	4.45	13
Great West of Ireland	38.19	33.65	4.54	12
Lancashire and Yorkshire	41.94	35.53	6.41	15
London and North-Western	38.21	32.83	5.38	14
London and South-Western	40.37	35.73	4.64	11
London, Brighton, & South Coast	35.99	31.85	4.14	12
Manchester, Sheffield, & Lincoln	37.60	32.51	5.09	14
Midland	35.97	28.26	7.71	21
North-Eastern	39.99	33.89	6.10	15
South-Eastern	46.65	35.29	11.36	24

The accounts of a railway company, if properly made up, ought to show the number of passengers and goods carried per train-mile of passenger and merchandise trains respectively. In the absence of such *data* with reference to the United Kingdom we cannot estimate either the gross charge or the net profit per mile run. The working expenditure does not afford any clue to this desirable information. No more does the gross revenue, since the train-mile proportions of goods and passengers carried are unknown quantities.

In the United States the working expenses are not tabulated as they are in England and in Europe generally. It is therefore difficult to find exactly parallel *data* in regard to any one item. In the next table, however, we have abstracted from the Census Report for 1880 the items that make up the total expenditure incurred in working the railways of the United States for that year, and the percentage of each item on the total earnings for that year.

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Statement showing the Cost Incurred in the Maintenance of the Railways of the United States for the Year ended July 1, 1880.

Items.	Percentage of Total Expenditure.	Percentage of Earnings.
Repairs of road-bed and track	11.23	6.82
Renewal of rails	4.89	2.97
Renewal of ties	3.04	1.85
Repairs of bridges	2.55	1.55
Repairs of buildings	2.17	1.32
Repairs of fences, crossings, &c.	0.42	0.25
Telegraph expenses	1.01	0.62
Taxes	3.77	2.29
Total expenditure in maintenance of track, &c.	29.08	17.67
Repairs of locomotives	6.19	3.76
Repairs of carriages and cars	2.99	1.82
Repairs of wagons	6.40	3.89
Total for repairs of machinery and cars	15.58	9.47
Passenger train service	2.85	1.73
Passenger train supplies	0.33	0.20
Passenger car mileage	0.23	0.14
Freight train service	5.68	3.43
Freight train supplies	0.36	0.22
Freight car mileage	2.21	1.34
Fuel for locomotives	9.31	5.66
Water-supply	0.68	0.41
Oil and waste	1.06	0.65
Locomotive service	7.72	4.69
Agents and station service	10.42	6.33
Station supplies	0.81	0.49
Salaries of officers and clerks	3.46	2.10
Legal expenses	0.70	0.42
Insurance	0.26	0.16
Stationery and printing	0.76	0.47
Outside agencies and advertising	1.34	0.82
Contingencies and miscellaneous	6.04	3.67
Loss and damage—Freight	0.28	0.17
Property and cattle	0.31	0.19
Personal injuries	0.39	0.24
Expenses not specified	0.18	0.11
Total operating and general expenses	55.34	33.64
Aggregate expenses	100.00	60.78

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That the railways of Great Britain have not within recent years been managed with a perfect regard to economy has already been shown. The working expenditure, equally with the capital expenditure, supplies ample evidence of the fact. In 1860 the working expenditure of our railways as a whole amounted to 47 per cent. of the gross receipts. In 1871 they amounted to precisely the same figure; and although there had been considerable variations in the interval, they were always within the limits of 3 per cent. But in 1873 the working expenditure rose to 53 per cent. of the gross receipts, and in 1874 to 55 per cent. This probably was directly due to the coal famine, which greatly increased the cost of fuel. Hence the item of locomotive power rose from 7.92d. per train mile in 1870 to 10.81d. per train mile in 1874. The great rise that occurred in the price of metals may no doubt have contributed to the same result, since the average expenditure for maintenance of way rose from 5.89d. per train mile in 1870 to 7.85d. in 1874. But both these principal items have since been reduced in the case of locomotive power to 8.35d. per train mile, and in the case of maintenance of way to 5.82d. per train mile, bringing a total of the two items up to only 14.17d. per train mile in 1884, as compared with 15.61d. in 1870. In the interval everything has become cheaper, except perhaps the one item of labour, with regard to which it is probably correct to say that if it has not become nominally cheaper, it has at any rate become more economical, by reason of the more general use of mechanical appliances. And yet it appears, with all these points in their favour, the working expenditure has never since 1872 been under 50 per cent. of the gross revenue, and for the last three years it has been 53 per cent., or 6 per cent. more than in 1870.

There is still another test to which this matter may be brought. There is a remarkable lack of *rapport* between the average expenditure per train mile and the percentage

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of working expenditure to gross receipts, as the following figures for the railways of Great Britain show :—

Years.	Percentage of Working Expenditure to Total Receipts.	Total Expenditure per Train Mile.
1874	55	37.89
1875	54	36.88
1876	54	36.13
1877	54	35.82
1878	53	34.69
1879	52	33.00
1880	51	32.37
1881	52	32.28
1882	52	32.47
1883	53	32.17
1884	53	31.59

Here we find that, whereas the working expenditure per train mile fell from 37.89d. to 31.59d., or 16 per cent. there was only a fall of 2 per cent. in the percentage of working expenditure to total receipts. But what is more noticeable still is the fact that although the working expenditure per train mile was .78d. less in 1884 than in 1880, the percentage of working expenditure to total receipts was 2 per cent. more.

On the Continent of Europe the percentage of the working expenses on the gross receipts varies enormously as between one country and another. It appears to be highest, over a considerable area of operations, on the State lines worked by private companies in Austria-Hungary, where it reaches the very high figure of 92.36 per cent. It is next highest on the State lines of France, where it reaches 90 per cent. The same two countries furnish, on the railways belonging to private companies, the best examples of economical working, those of France being worked with 50.41 per cent. of the gross receipts, and those of Austria with only 44.80 per cent. The particulars for the State and private railways of Germany, Austria, Belgium, and France are given in the following return :—

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Statement showing the Total Receipts and Total Working Expenses on the Railways of Continental Europe.

Countries.	Total Receipts (1 fr. = 1000).	Total Working Expenditure (1 fr. = 1000).	Percentage of Working Expenses on Receipts.
Germany—			
State lines	911,631	476,462	52.30
Private lines worked by the State	98,328	52,196	53.10
Private companies' lines . .	146,237	77,686	53.50
Total for Germany . .	1,154,769	604,915	52.40
Austria—			
State lines	53,352	34,605	64.87
State lines worked by private companies . . .	4,235	3,912	92.36
Private lines worked by State .	57,090	33,848	59.45
" " " companies	589,845	212,838	44.80
Belgium—			
State lines	119,344	74,550	62.20
Companies' lines . . .	17,562	9,229	52.57
France—			
State lines, ...	24,414	21,979	90.03
Companies' lines . . .	1,067,956	538,448	50.41
State lines worked by companies	7,033	6,760	96.11

It must not, of course, be supposed that the lower proportions of working expenses are necessarily coincident with economical management, and the higher proportions the contrary. The figures must in all cases be considered relatively to the amount of the total gross receipts.

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CHAPTER IX.

LOCOMOTIVE POWER.

THERE is probably no subject connected with railway working that has been so fiercely contested, and with regard to which there have been so many important changes and developments as that of locomotive power. In this department of railway expenditure, there is equally scope for great waste and great economy. In general, it is perhaps not too much to say that the profits or losses of a railway may be traced to the efficiency or otherwise with which the locomotive arrangements are controlled. The form of the engines employed, their weight, their durability, the tonnage that they are made to carry over a given period, the cost of repairs, the fuel expenditure, and many other considerations that are of the first importance in relation to economical working, are primarily within the cognisance and command of the locomotive superintendent, so that it is essential in any analysis of railway economy to bestow careful attention on this aspect of our subject.

That there is a very great diversity of practice and results in reference to locomotive working is sufficiently proved by the fact that the cost of locomotive power varied in 1884 from a maximum of 10.75d. per train mile on the North-Eastern to a minimum of 7.13d. on the Manchester, Sheffield, and Lincolnshire; that the cost of repairs per engine varied from 4.32d. per train mile on the North-Eastern to 1.57d. on the Highland railways; and that the consumption of fuel per engine mile varied

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from a maximum of 47.48 lbs. per train mile on the Caledonian to a minimum of 28.92 lbs. on the London, Brighton, and South Coast Railways.

These differences are not to be understood as applying to conditions strictly relevant and parallel to each other. On the contrary, the circumstances under which different descriptions of traffic are worked are often so dissimilar that no proper comparison is possible. If anything, we have to make a contrast rather than a comparison, in considering the light passenger traffic of the southern lines with the very heavy goods traffic of the Midlands and the north of England—the very lightly-laden trucks that are generally found running in agricultural districts with the full truck-loads that are invariably found in the working of mineral traffic in manufacturing centres.

When, therefore, we state that the cost of locomotive power had increased from 8.13d. per train mile in 1869, on the railways of the United Kingdom as a whole, to 11.09d. in 1873; had fallen again to 8.13d. in 1880, and increased again to 8.35d. in 1884, these figures in themselves, unaccompanied by any explanatory comments, might very seriously misrepresent the true state of the case. The fact is, that during this interval, brief as it is, the conditions under which the traffic of our leading lines is worked had greatly changed. In the earlier days of the railway system the locomotive engines employed were very much lighter than they have since become. In 1850, engines of 25 tons weight were regarded as very heavy, and so were 35 tons engines in 1860. In 1870, comparatively few engines were 40 tons in weight. Now however, many engines are running on the Continent, and some in this country, that weigh 45 to 50 tons, exclusive of the tender, and locomotives have been constructed that weigh as much as 60 tons.[1]

[1] In 1862, Mr. Meyer exhibited at Vienna an engine that weighed 60 tons, and had a tractive force of 22,000 lbs., equal to the draught of 2300 tons, exclusive of engine, on a level.

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Again, it is not to be assumed that the locomotive engines that give the greatest mileage over a given period are necessarily the most economical. It may very well happen, indeed, that the contrary is the case. The higher the speed at which a locomotive is worked, the greater the expenditure all round. Increased speed entails greater wear and tear, both in locomotives and in permanent way, and a larger consumption of fuel; and it is a moot point with railway authorities how far these extras are compensated for by the additional work got out of the rolling stock. The locomotive cost of working the railway traffic of the United Kingdom in 1884 was over 26 per cent. of the total cost per open mile, amounting to £503 on a total working cost of £1904. Anything that tends to increase this serious item of working expenditure ought, therefore, to be very critically examined in all its bearings. The element of speed is most important. It is a cardinal article of a locomotive engineer's creed and practice that the resistance of the atmosphere to the passage of a train is proportionate to the square of the velocity of a train.[1]

It might naturally be expected that some light would be shed upon the comparative cost of working locomotives at high and low rates of speed, by an analysis of the locomotive expenses of railways having different descriptions of traffic—that is to say, we might expect to find that on lines that chiefly carry passengers the locomotive expenditure would be relatively high, and that on the great mineral-carrying lines it would be relatively low. This, again, however, will be found a very unreliable test to apply, unless we can obtain access, not only to the average rate of speed for all trains, but to the average weight of the train, the age and weight of the locomotives, the character of the permanent way, and other determining considerations. The expenditure per train mile in respect of locomotive

[1] It has been found in the case of ocean-going steamers that an increase of speed from 11 to 12½ knots per hour involved an additional expenditure of 47½ per cent. for fuel.

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power was, in 1884, as under for the principal English mineral-carrying lines :—

Railways.	Expenditure per Train Mile.
	d.
Great Northern	7.62
Lancashire and Yorkshire	8.19
London and North-Western	7.86
Manchester, Sheffield, and Lincoln	7.13
Midland	7.67
North-Eastern	10.75

—while for the principal passenger-carrying lines, the corresponding expenditure in the same year was as under :—

Railways.	Expenditure per Train Mile.
	d.
South-Eastern	8.61
Great Eastern	8.56
London, Brighton, and South Coast	8.97
London and South-Western	9.68
Great Southern and Western of Ireland	9.09

But these figures do not, after all, go a long way in clearing up the question, seeing that the passenger-carrying lines have generally to pay a much higher price for their fuel,[1] in consequence of being remote from the coal-fields; while the North-Eastern Railway, which has probably the command of the cheapest fuel in the United Kingdom, and is at the same time the greatest mineral-carrying line, has the highest locomotive train-mile expenditure of the whole.

It has been contended in several quarters that the cost of motive-power on English lines is much higher than it ought to be, considering the comparative cheapness of fuel and labour. Mr. Dorsey [2] has calculated that in England the expenditure on this account is almost double what

[1] The cost of fuel per ton varied in 1885 from 5s. 10d. in the case of the Lancashire and Yorkshire Railway, to 17s. 8d. in the case of the North London.

[2] Paper read before the American Society of Civil Engineers, January 1886.

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it is on American lines when the latter is reduced to English prices. The details of his comparison of fourteen leading English and ten leading American lines are summarised in the following table, in percentages of the total operating or working expenses :—

Items.	English Lines.	American Lines.	American Percentages after Reducing the Cost of Fuel and Labour to English Rates.
	Per cent.	Per cent.	Per cent.
Fuel	7.2	9.6	4.6
Wages	8.6	7.1	3.6
Repairs and renewals of locomotives . .	7.8	6.1	4.6
Totals . . .	23.6	22.8	12.8

Mr. Dorsey maintains that this rather remarkable result is not an accidental feature of a single year's working, but one that is confirmed by an analysis of the annual cost of motive-power on the principal railways of both countries over a series of years. He does not, however, seek to explain the reasons for the difference which he seeks to establish in favour of American working. It is to be regretted that this has not been attempted, since the matter is one of vital importance, in the interests alike of railway shareholders and of the general public.

In considering the cost of any specific commodity or product, regard should be had to a given standard of comparison. In attempting to frame an estimate of the comparative expenditure incurred in locomotive power, that standard is manifestly the amount of service rendered, or work done. In Mr. Dorsey's comparison of English and American railroads, this standard does not appear to

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have been kept adequately in view. In order to place the matter on what we conceive to be a more reasonable and intelligible basis, we have applied this standard to Mr. Dorsey's figures, and the result hardly appears to bear out his statement of results.

The first test to which we propose to submit the figures is that of the cost of locomotive power per train-mile run. This is not necessarily an infallible test, as every engineer must be fully aware. The service rendered by a locomotive cannot be adequately measured by any such standard, since there are no criteria whereby to estimate the useful effect of the mileage so dealt with, and the locomotive may be simply shunting a wagon, or hauling empties in one case, and in another it may be hauling a load of 1000 tons at the rate of 30 miles an hour. In both cases, the work done is expressed in the same terms of mileage run. In the United States, as we show elsewhere, the average work performed by a locomotive per train-mile run, as tested by the average earnings per train-mile, is considerably higher than in the United Kingdom, and this fact is entitled to the fullest consideration. Subject, then, to these qualifications, we find that the average expenditure for locomotive power per train-mile on the ten railways selected by Mr. Dorsey is not less than 12d.; and if we cast out the Baltimore and Ohio Railway, which appears to show the remarkably low average of 5d. per train mile, the average comes out as 14d. per train mile. Against this, we have an average of only 8.7d. per train-mile for the ten principal railways in the United Kingdom—again the same railways, by-the-bye, that Mr. Dorsey selected, but reduced in number from fourteen to ten, in order that the conditions of the comparison may, as far as possible, be strictly parallel to each other. The details for both sets of railways are given in the following tabular statements (I. and II.):—

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I. *Statement showing the Total Working Expenditure and the Expenditure for Locomotive Power on Ten of the Principal English Railways in* 1884.

Railways.	Total Train Miles (1 = 1000).	Total Working Expenses (£1 = 1000).	Average per Train Mile.	Cost of Locomotive Power.	Average Cost per Train-Mile	Percentage of Total Working Expenditure Incurred for Locomotive Power.
		£	s.	£	d.	
Great Northern	16,978	1,985	2.3	539,108	7.6	27.1
North-Eastern	23,873	3,371	2.8	1,069,600	10.8	31.7
Midland	33,262	3,916	2.4	1,063,037	7.7	26.5
London and North-Western	38,184	5,224	2.7	1,250,909	7.9	24.0
Great Western	30,457	3,766	2.5	976,485	7.7	26.5
Great Eastern	14,054	1,793	2.6	501,457	8.6	27.8
Caledonian	12,490	1,568	2.5	423,099	8.1	26.9
North British	11,676	1,276	2.2	314,236	6.5	24.6
London and South-Western . . .	11,184	1,675	3.0	451,041	9.7	26.9
London, Brighton, and South Coast . .	8,136	980	2.4	304,186	10.1	31.1
Totals and averages . .	190,294	£25,554	2.7	£6,893,158	8.7	27

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II. *Statement showing the Total Working Expenditure, and the Proportion thereof Due to the Locomotive Power on Ten Leading American Railways in* 1884.

Railways.	Total Train Miles (1=1000).	Total Working Expenditure (£1=1000).	Average per Train Mile.	Total Expenditure for Locomotive Power.	Average per Train Mile.	Percentage of Total Operating Expenses Incurred for Locomotive Power.
		£	s.	£	d.	
Boston and Albany	4,960	1,157	4·7	363,400	18	31.3
Boston and Lowell	1,915	519	5·4	136,400	17	26.3
Boston and Maine	1,829	520	5·7	121,700	16	23.4
Boston and Providence	973	341	7·0	74,600	18	21.9
Old Colony	2,429	736	6.1	159,000	16	21.6
New York, New Haven, and Hartford	3,827	1,202	6.0	216,400	14	18.0
New York, Lake Erie, and Western	11,304	3,017	5·3	688,600	15	22.8
New York Central and Hudson River	16,452	4,462	5·4	1,040,000	15	23.3
Pennsylvania—Pa. Division	20,791	4,400	4·2	962,500	11	21.9
Baltimore and Ohio	17,110	1,537	1.8	355,000	5	23.1
Totals and averages	81,590	£17,891	4·4	£4,117,600	12	23.0

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It will be observed that while the average locomotive expenditure per train-mile is absolutely higher in the United States, it is relatively lower, being only 23 per cent. of the total working expenditure, as compared with 27 per cent. for the United Kingdom. This fact is manifestly not without importance, and it is made a good deal of in comparisons of English and American railways; but the truest test would seem to us to be that of the expenditure per train-mile. Although not strictly germane to the point under consideration, attention may suitably be directed to the fact that the average working expenditure per train mile on the railways dealt with, under all heads, is 4.4s. in the United States, and 2.7s. in the United Kingdom, showing an increase of 1.7s. per train mile for American lines, or 63 per cent. In a subsequent chapter we shall show how this remarkable difference arises, so far as it is capable of elucidation by the figures at command.

There is still another method of instituting a comparison of the cost of motive-power as between different countries, which we propose to apply to the case under consideration. It is that of the average annual expenditure for power per locomotive employed, including, of course, as before, the several items of fuel, repairs and renewals, and drivers' wages, &c. The next two tables (III. and IV.) have been compiled for the purpose of showing the results of this test as regards the English and American lines already specified. It will be observed that, on the ten English lines dealt with, the average annual expenditure incurred per locomotive employed has been £636, the average number of train miles run for that expenditure being 17,539. In the United States, the average annual expenditure per locomotive has been £1151, and the average number of miles run has been 23,928. To run and maintain the American locomotive has, therefore, cost £515, or 80 per cent. more over the year than has been spent on its English congener, against which there

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is to be placed the fact that the American locomotive has done an average of 6389, or 37 per cent. more miles than the English one. This does not appear to justify the assumption that American motive-power is less costly than English, but seems, on the contrary, to point to quite a different conclusion. It is desirable that we should not overlook the fact that both averages are made up of great and entirely inexplicable extremes. On the English lines, the South-Western shows a maximum of £900, and the North-Western a minimum of £505, per locomotive. On the American lines, the *maxima* and *minima* are still more remarkable—the New York, New Haven, and Hartford having an average as high as £1774, and the Baltimore and Ohio one as low as £557, per locomotive. In the latter case, therefore, we find one line with just about three times the average annual expenditure of another, with which we should be justified in expecting it closely to correspond. There are equally unaccountable differences in the annual mileage got out of the locomotives on different lines. The details of the comparison are presented herewith:—

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Statements showing the Annual Expenditure Incurred for Locomotive Power on Ten Leading Lines in the United Kingdom and in the United States, with the Average Annual Number of Train Miles run per Engine in each case.

III.—*English Locomotives.*

Railways.	Number of Locomotives.	Total Expenditure on Locomotive Power.	Average Annual Expenditure per Locomotive.	Total Train Miles Run (1=1000).	Average Train Miles per Locomotive.
Great Northern	789	£539,108	£683	16,978	21,518
North-Eastern	1,470	1,069,600	728	23,873	16,240
Midland	1,697	1,063,037	626	33,262	19,600
London and North-Western	2,476	1,250,909	505	38,184	15,422
Great Western	1,577	976,485	617	30,457	19,313
Great Eastern	655	501,457	766	14,054	21,456
Caledonian	690	423,099	613	12,490	18,101
North British	585	314,236	537	11,676	19,959
London and South-Western	501	451,041	900	11,184	22,323
London, Brighton, and South Coast	410	304,186	742	8,136	19,844
Totals and averages	10,850	£6,893,158	£636	190,294	17,539

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IV. *American Locomotives.*

Railroads.	Number of Locomotives.	Total Expenditure on Locomotive Power.	Average Annual Expenditure per Locomotive.	Total Train Miles (1 = 1000).	Average Number of Train Miles per Locomotive.
Boston and Albany	244	£363,400	£1489	4,960	20,000
Boston and Lowell	77	136,400	1771	1,915	25,000
Boston and Maine	89	121,700	1367	1,829	21,000
Boston and Providence	53	74,600	1408	973	18,000
Old Colony	120	159,000	1325	2,429	20,000
New York, New Haven, and Hartford	122	216,400	1774	3,827	31,000
New York, Lake Erie, and Western	785	688,600	877	11,304	14,000
New York Central and Hudson River	655	1,040,000	1588	16,452	25,000
Pennsylvania—Pa. Division	795	962,500	1211	20,791	26,000
Baltimore and Ohio	637	355,000	557	17,110	27,000
Totals and averages	3577	£4,117,600	£1151	81,590	23,928

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There is still another point that requires to be put in the foreground in any attempt to compare the cost of locomotive power in different countries and on different railways. It is a well-known fact that passenger traffic costs less, both in fuel and in engine repairs, than heavy goods, and especially coal, traffic. It seldom happens that exact *data* as to the differences arising in this respect are at command, but the following comparison, which we have collated from a good authority,[1] will show approximately how the two descriptions of traffic compare as regards the cost of fuel:—

Railways.	Consumption of Fuel per Engine Mile in	
	Passenger Engines.	Goods Engines.
	lbs.	lbs.
Great Southern and Western of Ireland	23.36	37.6
Philadelphia and Reading . . .	57	87
Paris, Lyons, and Mediterranean . .	35.15	66.94
Averages . .	38.50	63.85

It would appear to follow from these figures that the consumption of coal by goods engines is about 25.35 lbs., or 66 per cent., higher than in the case of passenger engines. In the working of mineral traffic the consumption of fuel is greater still, the Philadelphia and Reading Railway returning their average at 121 lbs. of anthracite coal per mile, as compared with 87 lbs. in the case of ordinary goods engines.

It is much the same with regard to the cost of repairs

[1] Paper on "The Repairs and Renewals of Locomotives," by Alex. M'Donnell. *Minutes of Proceedings of the Institution of Civil Engineers*, vol. 48, pp. 7, 18, and 25.

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and renewals, although not to an equal extent. From the source already quoted, we extract the following figures, showing the differences that have been found in this regard on leading lines in the United Kingdom, the United States, and France:—

Railways.	Cost of Repairs and Renewals per Engine Mile in	
	Ordinary Passenger Engines.	Ordinary Goods Engines.
	d.	*d.*
Great Southern and Western of Ireland	.809	.900
Philadelphia and Reading . . .	2.10	2.13
Paris, Lyons, and Mediterranean .	2.54	3.34
Averages . .	1.816	2.123

In this item there would seem to be, on an average of these three lines, a difference of .307d. per mile against the goods engines, being equal to about 17 per cent. In the case of coal traffic, the Philadelphia and Reading Company calculate their engine repairs at 3.13d. per mile, which is about 50 per cent. more than the average of the passenger engines. Assuming this difference, more or less modified, to be of general application, it is clear that in the United Kingdom, where there is a much larger coal traffic than in any other country in the world, the expenditure for motive-power might fairly be expected to be correspondingly more.

With reference, however, to the ten typical lines of each country selected by Mr. Dorsey, and adopted by ourselves, for the purposes of a comparison of the United Kingdom and the United States, there does not seem to be any point in favour of English lines, as regards the character of the traffic carried. On the contrary, the ten

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American lines, with a total mileage of 81,587,000, have run 51,150,000 miles, or 63 per cent. of the whole, in goods trains. The United Kingdom, on the contrary, shows, with regard to the selected lines, a total train mileage of 200,291,000, of which 99,497,000 miles, or 50 per cent., were goods trains. This difference manifestly, to a certain extent, explains and justifies the higher expenditure for locomotive power, per train mile and per locomotive employed, that we have found to prevail in the United States. It may at the same time be remarked that in both cases the more important mineral carrying lines are embraced in the comparisons, and that a comparison of the two countries as a whole would bring out a rather different result. Particulars are contained in Tables V. and VI.:—

V. *Statement showing the Comparative Mileage of Goods and Passenger Trains on Ten Principal British Railways in* 1884.

Railways.	Mileage of Goods Trains (1 = 1000).	Mileage of Passenger Trains (1 = 1000).	Total Mileage (1 = 1000).	Percentage of Goods Train Mileage on Total.
Great Northern . . .	8,214	8,764	16,978	48
North-Eastern . . .	13,955	9,918	23,873	58
Midland	19,700	13,561	33.261	59
London and North-Western .	18,437	19,747	38,184	48
Great Western . . .	15,836	14,621	30,457	52
Great Eastern . . .	5,502	8,551	14,053	39
Caledonian	6,910	5,579	12,489	55
North British . . .	6,435	5,241	11,676	55
London and South-Western .	3,075	8,109	11,184	27
London, Brighton, and South Coast . . .	1,433	6,703	8,136	18
Totals and average . .	99,497	100,794	200,291	50

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VI. *Statement showing the Comparative Mileage of Goods and Passenger Trains on Ten American Railroads.*

Railroads.	Mileage of Goods Trains (1 = 1000).	Mileage of Passenger Trains (1 = 1000).	Total Mileage of all Trains (1 = 1000).	Percentage of Goods Train Mileage on Total.
Boston and Albany . .	3,010	1,949	4,959	61
Boston and Lowell . .	610	1,305	1,915	32
Boston and Maine . .	540	1,289	1,829	30
Boston and Providence . .	246	727	973	25
Old Colony	799	1,629	2,428	33
New York, New Haven, and Hartford . . .	1,461	2,365	3,826	38
New York, Lake Erie, and Western . . .	7,513	3,791	11,304	66
New York Central and Hudson River . .	10,027	6,425	16,452	61
Pennsylvania—Pa. Division .	15,015	5,776	20,791	72
Baltimore and Ohio . .	11,929	5,181	17,110	70
Totals and average . .	51,150	30,437	81,587	63

Hitherto we have limited our comparison of the cost of locomotive power in the United Kingdom and the United States to a number of selected lines in both countries, selected, not by us, but by the author whose statements and conclusions we have deemed it desirable to traverse. It is, however, possible to carry the matter further than this, since there are in existence *data* concerning the general working expenses of all the railroads of the United States for the year 1880, collected for census purposes.[1] In the absence of such statistics for a later period, we must have recourse to those for that year; but it is scarcely probable that, in the comparatively short interval that has since elapsed, the general character and scope of the facts will have altered very materially.

Taking the railroads of the United States as a whole, the expenditure incurred in 1880 under the head of

[1] Report on the Agencies of Transportation in the United States, including the Statistics of Railroads, &c. Washington, 1883.

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locomotive power was 88,048,000 dollars, divided as follows:—

Fuel	32,836,000 dollars
Water-supply	2,388,000 ,,
Locomotive service	27,239,000 ,,
Repairs, &c.	21,831,000 ,,
Oil and waste	3,754,000 ,,

And as the total train mileage for the same year was 463,341,000 miles, it follows that the average cost of locomotive power per train mile was approximately 9.1d.[1] The average expenditure under the same heading and for the same year was, in the case of the United Kingdom, 8.1d. per train mile,[2] so that there was a difference of 1.0d., or about 12 per cent., against the railways of the United States.

On comparing this item of 8.5d. per train mile with the 12d. per train mile which we found to be the average cost of motive-power on Mr. Dorsey's ten selected lines, the difference is so startling as to suggest either that on the latter lines the average expenditure on this account is considerably higher than that of the country as a whole, or that the locomotive expenditure has largely increased in the interval. Both reflections are probably more or less accurate. It is certainly true that since 1880 the average load carried per train mile has been considerably augmented, and it may safely be assumed that locomotive expenses have proceeded on the same lines.

The considerations just stated naturally lead up to that of the comparative earning power of English and American locomotives. This question, while not less important than that which has been already dealt with, is even more readily demonstrable by figures.

In the United Kingdom, the total number of locomo-

[1] In this calculation, the dollar has been converted at 4s.

[2] Messrs. Calcraft and Giffen's General Report to the Board of Trade on the Railways of the United Kingdom for 1880.

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tives returned as being in the possession of all the railways in 1884 was 14,827. The total gross receipts from all traffic for the same year was 67¾ millions sterling. The gross earnings of each locomotive would therefore appear to have been about £4586.

In the United States, the total number of locomotives returned as belonging to the railways as a whole was 23,823, and the gross earnings from all sources amounted to about 202 millions sterling, so that the average gross earnings per locomotive amounted to about £8476. It would therefore seem as if the American locomotives each earned a sum of £3890, or 84 per cent., more than the locomotives on English lines. It must not, however, be forgotten that, in the United States, the railways have a considerable revenue from coal lands and other sources, with which locomotives have really nothing to do. In the returns for 1883, the gross earnings from passenger and freight traffic are returned at 188 millions sterling, so that there was a difference of about 14 millions earned from other sources than transportation. Even, however, when we have deducted this last-named sum from the 202 millions returned as the gross revenue from all sources, there still remains a really astounding difference in favour of the earning power of the American locomotive.

When we come to consider the net earning capacity of English and American locomotives, we find equally remarkable differences. The total net receipts from railway working in the United Kingdom in 1884 amounted to 33¼ millions sterling, which corresponds to an average of £2246 per locomotive; whereas, in the United States, the net transportation earnings amounted to a total sum of 73 millions sterling, giving an average of £3064 per locomotive, which is £818 per locomotive, or 36 per cent., higher than the average for the United Kingdom.

At the first blush it would appear that this greater earning power of American locomotives must be due

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either to the existence of a higher range of rates and fares in the United States, or to the fact that they run a considerably greater average mileage, or to a greater average train-load, or to all of these causes combined.

There is no reason for supposing that the first of these presumed influences has anything to do with the matter, since the average charges for the transport of both goods and passengers, but especially the former, are much lower on American than on English lines, or indeed on any European railways.

We come, then, to consider how far the apparent superiority of American locomotive earnings is affected by the greater average mileage run per locomotive.

The total number of train miles run by the 14,827 locomotive engines in the United Kingdom was 272,803,000, being an average of 18,395 miles per engine. In the United States, the 23,823 locomotives ran a total distance of 538,011,000 train miles, being an average of 22,583 per engine. In the United States, therefore, each locomotive covered during the year 4188 miles, or 23 per cent., more than the locomotives of the United Kingdom.

It is, however, necessary to proceed further even than this before we can get at the whole truth of the matter. After all, the real secret of the higher average earning capacity of the American locomotive is not due so much to the greater average mileage which it performs, as to the greater average load which it draws. This is sufficiently evident from the circumstance that, while the average gross receipts per train mile in 1885 amounted in the United Kingdom to 4s. 10d., they were not less than 7s. 5d. in the United States, showing a difference of 2s. 7d., or 54 per cent., in favour of the latter country, and that, too, notwithstanding the lower range of rates that prevails on American railroads.

Unfortunately, there are no reliable materials at command for a comparison of the average weight of the live, or paying, load in the two countries. In the United

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States, the number of tons carried one mile in 1883 was returned at 44,065 millions, and by dividing into this sum the 350 millions of train miles run by goods trains, it would appear as if the average number of tons carried per train mile was 126. In the absence of any specific returns of ton-mile traffic on English lines, any attempt to compute the average weight of the trains would necessarily be conjectural.

The gross and net earning power of locomotives on English lines has shown a decrease within recent years. The gross earnings have fallen from £5039 in 1874 to £4611 in 1884; and the net earnings have fallen within the same period from £2248 to £2167. The details are appended :—

Gross and Net Earning Power of English Locomotives.

Years.	Number of Locomotives.	Total Gross Earnings (£1 = 1000).	Total Net Earnings (£1 = 1000).	Gross Earnings per Locomotive.	Net Earnings per Locomotive.
1874	9,554	£48,142	£21,476	£5,039	£2,248
1875	10,000	49,771	22,473	4,977	2,247
1876	10,439	50,504	23,000	4,838	2,203
1877	10,636	51,063	23,367	4,801	2,197
1878	10,804	51,069	23,915	4,727	2,214
1879	10,977	50,437	24,222	4,595	2,207
1880	11,172	53,598	26,033	4,805	2,330
1881	11,474	54,924	26,348	4,787	2,296
1882	11,847	56,596	26,849	4,777	2,266
1883	12,144	57,978	27,399	4,774	2,256
1884	12,482	57,557	27,043	4,611	2,167

Whether the decrease of earning capacity here exhibited is due to a reduction of the train load, or to a reduction of the average tariff charges, is not apparent on the face of it. The gross earnings per locomotive in the United States were £6420 in the census year 1880, and £6800 in 1883.

Coming now to deal with the Continent of Europe, we find that the number of locomotives, and the average annual and daily mileage of each, on the principal railway

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systems—distinguishing the State from the private or companies' lines—were, in 1883, as under:—

Statement showing the Total Number of Locomotives in Different Countries, the Number of Train-Miles, and the Average Mileage Run per Locomotive Annually, and per Day.

Countries.	Number of Locomotives.	Train-Miles (1 = 1000).	Average Miles per Locomotive per Annum.	Average Miles per Locomotive per Day.
Germany—				
State railways	8,938	105,613	11,816	32
Private railways worked by State	932	10,812	11,601	32
Companies' railways	1,460	18,062	12,371	34
Totals	11,330	134,489	11,870	33
Austria—				
State railways	410	5,819	14,193	39
Private lines worked by the State	382	6,029	15,783	43
State railways worked by companies	50	627	12,540	34
Companies' railways	2,829	34,668	12,255	34
Totals	3,671	47,144	12,842	35
Belgium—				
State railways	1,570	21,550	13,726	38
Companies' railways	220	2,320	10,545	29
Totals	1,790	23,870	13,335	37
France—Lines of general interest				
State railways	376	6,576	17,489	48
State railways worked by companies	18	2,355	...	...
Companies' railways	7,496	122,822	16,385	45
Lines of local interest—Private railways	198	4,106	20,737	57
Totals	8,088	135,860	16,798	46
Italy—				
State railways	1,630	24,642	15,118	41
Luxembourg	34	433	12,735	35
Norway	111	1,557	14,027	38
Netherlands	519	11,435	22,033	60
Roumania	211	2,207	10,460	29
Russia	5,844	61,940	10,599	29
Finland	98	1,177	12,010	33
Switzerland	595	7,674	12,897	35

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According to these figures, it would appear that the greatest amount of work was got out of the locomotives employed on Dutch railways and on local lines in France; the next greatest on the State lines of the latter country; while the third place is occupied by the French private lines of general interest. In Germany, the average appears to be pretty uniform, as regards both State and companies' lines.

In India the average mileage run by locomotive engines varies quite as much as in European countries, as the following figures show:—

Statement showing the Average Number of Locomotives Employed on the Principal Broad Gauge Railways in India, and the Average Work obtained from each during the Year 1883.

Railways.	Number of Locomotives.	Total Engine Mileage (1 = 1000).	Average Annual Mileage per Engine.	Average per Engine per Day.
East Indian . . .	536	11,982	22,355	61.2
Great Indian Peninsula .	447	8,943	20,007	54.8
Madras	150	2,172	14,478	39.6
Bombay, Baroda, and Central India .	100	2,210	22,101	60.6
Eastern Bengal . . .	48	1,019	21,231	58.1
Said, Punjaub, and Delhi .	159	3,306	20,781	56.9
Oudh and Rohilcund . .	125	1,781	14,248	39.0
Indus Valley and Candahar	156	2,195	14,069	38.5
Nizam's	9	311	34,514	94.5
Totals and averages .	1730	33,919	19,606	53.71

The average mileages shown by the East Indian and the Bombay, Baroda, and Central Indian Railways are much higher than are generally to be found on European lines. On the other hand, the results shown for the Madras and the Oudh and Rohilcund lines are below the European average.

It is, however, to be borne in mind that the question of the average daily or yearly mileage of a locomotive engine is not to be determined by its own capacity alone. It is a

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problem that has other factors surrounding and influencing it, that must be taken into account. One of these is the most economical rate of speed. Another is the endurance of the men in charge.

The greatest proportion of the locomotives employed in the principal countries of the world are engaged on goods traffic. That traffic may be regarded as worked with a minimum of economy at the rate of 15 to 18 miles per hour. If the lower figure be taken, it is clear that, unless the enginemen are to be kept on duty for more than ten hours per day, it is not economically practicable to run the same engine for more than 150 to 160 miles per day.

Sir Daniel Gooch specifically stated to the Royal Commission of 1866 that on the Great Western line the average to which the engines were generally worked was about 160 miles per day. He added, however, that without undue wear and tear an engine should do as much as 200 miles per day, if the endurance of the men permitted.

In the United States most of the principal lines now adopt a system known as "first in, first out," which is designed to obtain a higher average mileage from the locomotive without exacting too much from the men in charge. The principle of the system is, that the next engine staff or crew in order shall take the next engine in order, and, thus, by having many more engine-hands than are absolutely required to man the locomotives, something like 50 per cent. more service is got from the engines. By the adoption of this system, the Pennsylvania Railroad Company increased the annual mileage per locomotive from 19,244 miles in 1870 to 27,644 in 1881.[1]

Regarding the cost of working locomotive engines over a series of years, it appears that the average has within the last few years shown a substantial decline. On the principal British railways the decrease has varied from

[1] "Report on the Internal Commerce of the United States for 1882," p. 301.

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a minimum of 21 per cent. on the Lancashire and Yorkshire and North-Eastern Railways to a maximum of 30 per cent. on the South-Eastern. In only one case—that of the South-Western—has there been an increase in the later year. The figures are appended :—

Statement showing the Cost of Locomotive Power per Train Mile on the Principal English Railways in 1874 and 1884.

Railways.	1874.	1884.	Decrease in 1884.	Percentage of Decrease in 1884.
	d.	*d.*	*d.*	Per cent.
London and North-Western . .	10.38	7.86	– 2.52	24
Caledonian	10.72	8.13	– 2.59	24
Great Eastern	11.35	8.56	– 2.79	25
Great Northern	9.92	7.62	– 2.30	23
Great Western	9.29	7.69	– 1.60	17
Great Western of Ireland . .	11.14	9.09	– 2.05	18
Lancashire and Yorkshire . .	10.24	8.10	– 2.14	21
London and South-Western . .	9.42	9.68	...	...
London, Brighton and South Coast	11.97	8.97	– 3.00	25
Manchester, Sheffield and Lincolnshire	9.30	7.13	– 2.17	23
Midland	10.84	7.67	– 3.17	29
North-Eastern	13.67	10.75	– 2.92	21
South-Eastern	12.38	8.61	– 3.77	30

In order, however, to fully appreciate the extent of the economy that has been effected in locomotive power, it is necessary to go much farther back than 1874. The most remarkable results in this direction took place prior to that date.

In 1865, locomotive and traffic charges amounted to 64.95 per cent. of the whole, and in 1884 they were 27 per cent. of the whole cost of working per train mile. The variations which this item had undergone up to 1867 are thus referred to in the Report of the Royal Commission issued in that year.

"The Reports of the Board of Trade show the following to have been the cost per train mile for 1840:—

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	d.
Coke	8.356
Oil	0.360
Wages of enginemen and firemen	1.510
Wages of labourers and cleaners, &c.	1.910
Superintendent, clerks, office charges, firemen	2.040
Repairs	3.549
Sundries	0.936
Total	18.661

"Soon after that time an essential improvement took place in the construction of engines by the introduction of the system of working steam expansively, and in 1845 the following appears to have been the cost per train mile on the Great Western Railway:—

Items.	Passenger Trains.	Goods Trains.
	d.	d.
Cost of repairs	3.03	2.34
„ coke	3.13	5.26
„ enginemen and firemen's wages	1.34	1.16
„ general charges	1.64	1.94
Total	9.14	10.70

"On the Great Western Railway, the cost in 1866 was as follows:—

	d.
Fuel	1.71
Wages of enginemen and firemen	1.49
Wages of cleaners and cokemen, &c.	.43
Oil, tallow, and sundry stores	.28
Wages and materials for repair and renewal of engines and tenders	3.24
Water, including pumping-engines	.18
Salaries of superintendents	.16
Gas rates, buildings, and fire charges	.13
Total	7.62
Or more accurately, as deduced from the cost and mileage	7.65

"This average may be resolved into 6.75d. per train mile for passengers, and 8.5d. per train mile for goods.

"The repairs to engines and carriages, including the rent

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of wagons which the company hire, amounted to 3.57d. per train mile; hence the average cost of a train for all these charges was 11.22d. per mile run in 1866."

The following table shows the cost of trains per train mile on the Great Northern Railway:—

Items.	Engines.	Carriages and Wagons.	Totals.
	d.	d.	d.
The cost of working passenger trains averaging 7 carriages . . .	5.90	1.47	7.37
The cost of working passenger trains averaging 8½ carriages . . .	7.63	1.74	9.37
The cost of working passenger trains averaging 10½ carriages . . .	8.54	2.21	10.75
The cost of working goods trains averaging 25 carriages . . .	8.99	2.60	11.59
The cost of working passenger and goods trains averaging 16½ carriages	8.50	2.26	10.76

The items of expenditure which make up the total expense of working the trains on the Great Western Railway are shown in detail for 1865 in the following statement supplied by Sir Daniel Gooch:—

Items.	Cost per Train Mile. s.	d.
Maintenance of way	0	6.35
Locomotive	0	7.65
Carriage and wagon repairs	0	3.37
Rent for wagons	0	.19
Traffic charges	0	6.91
General charges	0	2.74
Compensation	0	.45
Furniture, &c.	0	.13
Working joint lines and stations	0	.99
Fire insurance	0	.07
General office expenses	0	.62
Government duty	0	1.12
Miscellaneous expenses	0	.04
Rates and taxes	0	1.10
Bad debts	0	.06
Stamps for debentures	0	.02
Total . . .	2	7.81

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On the Great Northern Railway the following were the corresponding charges, as furnished by Mr. Sturrock to the Devonshire Commission:—

	Cost Derived from an Average of Ten Years.			For 1865.
	d.			d.
Engines	8.50	per train mile	. .	9.577
Carriages . . . 1.74	2.26	„	2.32	2.748
Wagons 2.60		„	3.00	
	10.76			12.325
Maintenance of way . . .	5.13	„	. .	5.880
Coaching and merchandise traffic, compensation, duty, &c. .	12.09	„	. .	12.480
Total working expenses . .	27.98	„	. .	30.685

The whole cost of working a train on the Great Western Railway for 1865 thus amounted to 2s. 7.81d. per train mile. On the Great Northern Railway, it was 2s. 6.685d.; on the South-Eastern Railway, 2s. 10.72d.; and on the Northern of France, 2s. 7.34d.

These figures sufficiently prove not only the great variations that have occurred in the cost of locomotive power, as between one period and another, but also the relation that this item of expenditure bore to each of the others. It is necessary to remember, in regard to these figures, that the economy is much greater than it appears on the surface, since the size and power of the locomotives have been very greatly increased, and the average train loads have also been augmented, although not, as we have elsewhere shown, to the extent that they should have been.

The following statement, which has been compiled from the reports of the London and North-Western Railway Company, shows in what items the economy has chiefly taken place over the last ten years:—

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Statement showing the Total Expenditure incurred for Locomotive Power on the London and North-Western Railway over the Ten Years ending 1885, with the Expenditure for that Year alone, and the Averages per Train-Mile for both Periods.

Items.	Total Expenditure for Period 1876–85.	Average per Train Mile.	Expenditure in 1885.	Average per Train Mile.
	£	d.	£	
Wages	4,323,829	2.9	466,600	2.8
Fuel	2,623,769	1.7	288,074	1.7
Water	107,844	0.07	8,485	0.05
Oil and stores . . .	463,866	0.31	54,707	0.32

There are many engineers who contend that the English locomotive is still an expensive machine as regards fuel consumption. Mr. Crampton, whose engines have been worked with such signal success for many years on the Northern of France, has recently had a report from the engineer-in-chief of that line, intimating that the average consumption of fuel in his engines over twelve years has varied from 24.8 lbs. to 29.9 lbs. per mile. This figure, on the face of it, appears to compare very favourably with the average of English lines, but it is needless to remark that it is not the *quantity* of fuel alone that is to be considered. The weight of the load carried, the *quality* of the fuel burned, the rate of speed, the condition of the locomotive, and other points equally manifest, must exercise each its share of influence in the determination of this problem.

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CHAPTER X.

ECONOMY OF FUEL.

In a previous chapter we have pointed out that locomotive power represented 26 per cent. of the total working expenditure per train mile of the railways of the United Kingdom in 1884. The several items that make up this sum are not specifically given in the Board of Trade returns, but they are tabulated in the railway companies' half-yearly reports, which show that, next to wages, fuel is the most expensive of the several items that make up the running account.

There are, however, remarkable differences as between one line and another, even in a matter that would seem to admit of so much uniformity of practice and results as that of fuel. These differences are sometimes dependent upon the type and age of the engines employed, sometimes upon the quality of the fuel, sometimes upon the average rates of speed, and sometimes upon the average weight of the train.

It is not without interest to examine these differences, so far as we have materials at command, with a view to ascertaining how far English railways compare favourably or otherwise with the railways of other countries.

But first let us look at the British railways in relation to one another. From the accounts of the two leading English lines—the London and North-Western and the Great Western—we have compiled the following statement of the several items that entered into the running expenses

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account for the year ending December 31, 1885, with the percentage proportion which each bore to the total:—

Statement showing the Expenditure incurred for Locomotive Power on the North-Western and Great Western Railways during the Year 1885.

Items.	London and North-Western.		Great Western.	
	Total Sum.	Per Cent. on Total.	Total Sum.	Per Cent. on Total.
Wages . . .	£466,600	57.0	£322,886	56.7
Fuel	288,074	35.2	194,448	34.2
Water	8,485	1.0	26,426	4.6
Oil, stores, &c. . .	54,707	6.7	25,202	4.4
Totals .	£817,866	99.9	£568,962	99.9

These figures are in themselves sufficient to prove that, in the working of two of the chief English railways, the conditions of which are as nearly as possible parallel and relevant to each other, there may be, and actually are, considerable variations that are no doubt largely attributable to local circumstances.

There is another valuable piece of statistical *data* that may be quoted on this head. From returns that have been compiled by one of our leading railways, and placed at the disposal of the author, the following returns of the average cost of fuel per ton and the average consumption of fuel per engine mile on two recent half-years are compiled for a number of the principal lines:—

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Lines with a High Average Consumption of Fuel.

Railways.	Half-year ending 31st December 1883.		Half-year ending 30th June 1885.	
	Cost of Fuel per Ton.	Fuel Consumed per Engine Mile.	Cost of Fuel per Ton.	Fuel Consumed per Engine Mile.
	s. d.	*lbs.*	*s. d.*	*lbs.*
London and North-Western	6 8	38.78	6 8¾	36.53
North-Eastern	7 7¾	37.35	6 11	37.25
Midland	6 9	37.07	6 8¼	37.48
Great Northern	7 9½	40.56	7 6	39.96
Great Eastern	11 8½	36.21	10 9	37.20
Manchester, Sheffield, and Lincoln	6 5¼	40.92	6 3	42.45
North British	5 3¾	41.57	5 0½	40.18
Caledonian	4 9	50.05	4 2¼	47.48
Glasgow and South-Western	5 6½	45.36	4 11	45.29
Lines with a Low Average Consumption of Fuel.				
London, Brighton, and South Coast	17 2	30.47	16 9¾	28.92
Metropolitan	16 6	29.52	16 7	34.41
District	17 3¾	30.22	16 11¼	31.77
Midland and Great Western of Ireland	14 2¾	28.29	14 2	28.91
Great Northern of Ireland	15 3	27.24	15 4¾	28.80
Belfast and Northern Counties	15 10	27.15	15 4	28.53

There are two facts that stand out with marked prominence in these returns—the first, that the largest consumption of fuel per engine mile is to be found on the lines that have the heaviest goods and mineral traffic; the second, that lines that pay the greatest average price for their fuel continue to work with the lowest nominal consumption.

There are other reflections that will naturally be suggested by an examination of the figures. It will be observed, on looking at the returns for the latest half-year, that the Manchester, Sheffield, and Lincolnshire Railway has an average consumption of fuel per engine mile of 42.45 lbs., whereas the North-Eastern Company, traversing a neighbouring district, and having much the same

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description of traffic all round, has an average of only 37.25 lbs. per engine mile.[1] If the former line had consumed the same average quantity of fuel per train mile as the latter, it would have made a difference on the train mileage of the Manchester, Sheffield, and Lincolnshire Railway in 1885 of nearly 16,000 tons of coal. It may be added that the economy of only 1 lb. of coal per engine mile would represent, on the train mileage of 1885, upwards of 120,000 tons.

Mr. Stroudley gives the following particulars of the consumption of coal by several leading types of engines employed on the London, Brighton, and South Coast Railway:—

Class of Engine.	Average Load Vehicles.	Average Running Speed, Miles per Hour.	Lbs. of Coal per Vehicle Mile.	Lbs. of Coal per Train Mile.
C. Goods . .	28.89	25.2	1.58	45.85
	40.42	16.3	1.31	53.24
B. "Gladstone" Passenger .	14.5	41.2	1.37	19.91
	25.0	43.3	1.06	26.55
D. "Tank" Passenger . .	6.81	32.3	2.23	15.23
	13.54	26.2	1.29	17.28
G. Passenger .	10.22	35.9	1.49	15.27
	14.00	38.6	1.72	24.20

It is a subject that may well afford cause for congratulation to engineers that they have brought the locomotive engine to such a high standard of efficiency that 1 lb. of coal will convey a ton weight of train 13½ miles at an average speed of 43½ miles per hour.[2]

There are other considerations to be borne in mind

[1] Of the total train miles travelled by the Manchester, Sheffield, and Lincolnshire Railway in 1885, 62 per cent. were mineral trains, as against 59 per cent. for the North-Eastern Railway, so that there was only a difference of 3 per cent. between the two lines.

[2] *Proceedings of the Institution of Civil Engineers*, vol. lxxxi. p. 102.

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besides the efficiency of the engine in examining the question of economy of fuel. It sometimes pays to burn a poor instead of a rich coal, although by doing so the poorer coal will show a much higher absolute consumption. Mr. Webb mentions, as an example of this fact, that he ran one link of trains in the South Staffordshire district with South Wales and the ordinary local coal, with a view to testing the comparative consumption of each for a given service. He found that the consumption of Welsh coal was 25.25 lbs. per train mile, while that of the local coal ran up to 32.82 lbs. per train mile; and yet it was cheaper to burn the local coal, because, although it was of poorer quality, there was less action on the tubes and fire-boxes, and the work was done more cheaply.[1]

In relation to results, there would appear to be a lower consumption of fuel on our leading lines at the present time than there was a few years ago. This fact will be borne out by an examination of the following particulars, which have been extracted from the reports of the several companies:—

Years.	London and North-Western Railway.			Great Western Railway.		
	Cost of Fuel.	Train Miles Run (1 = 1000).	Average per Train Mile.	Cost of Fuel.	Train Miles Run (1 = 1000).	Average per Train Mile.
	£		d.	£		d.
1876	311,606	32,583	2.3	191,634	25,599	1.9
1880	231,773	35,105	1.6	153,503	27,857	1.3
1882	253,198	36,999	1.6	184,164	29,591	1.5
1883	277,258	38,326	1.7	203,577	30,346	1.6
1884	283,118	38,184	1.8	207,532	30,457	1.6

These figures apply, of course, to prices only, and not to quantities; and it must not be forgotten that quantities are the true test of economy, since a fall of price may

[1] Vide *Minutes of Proceedings of the Institution of Civil Engineers*, vol. lxxxi. p. 134.

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cause the consumption to appear less, while it may really have increased, in reference to volume.

The materials at command for a comparison of the fuel consumption on English railways with that on railways abroad are not so full as could be desired. There are, however, some interesting and valuable *data* to be found in two reports that are well worthy the attention of those interested in this subject, the first being the Report on Transportation, &c., prepared by Mr. A. E. Shuman for the Tenth Census of the United States; and the second, Colonel Stanton's annual "Administration Report on the Railways of India."

In the first-named volume there occurs a series of tables exhibiting the consumption of fuel for locomotive purposes on the principal railways of the United States in the Census year 1880. From these returns we have compiled a table showing, as regards fourteen of the leading lines, the total consumption of fuel,[1] the total train miles run, and the average consumption of fuel per train mile. The result is truly remarkable; for if the figures are to be accepted as worth anything at all, they show an average ranging from a minimum of 37 lbs. per train mile on the Delaware, Lackawanna, and Western Railways, to a maximum of 174 lbs. on the Union Pacific line! We will perhaps do well to disregard this latter figure, as well as that brought out for the Missouri-Pacific line—112 lbs. per train mile—seeing that both are so abnormally large as to suggest the probability of error. We should then have to deal with a maximum of 79 lbs. on the Albany and Susquehanna line, which appears to be 28 lbs. per train mile, or 55 per cent. more than the average consumption on the Pennsylvania Railway—one of the greatest mineral-carrying lines in the United States. Herewith are the detailed figures:—

[1] In a number of cases certain quantities of wood were burnt as well as coal. The wood has in all cases been reduced to its coal equivalent at 1½ cords to the ton; but in the examples selected the quantities of wood used have been too small to exercise any appreciable influence on the result.

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Statement showing the Consumption of Fuel, the Train Mileage, and the Average Consumption of Fuel per Train Mile on Leading American Railroads in 1880 :—

Railroads.	Tons of Fuel.	Train Miles Run.	Average Consumption of Coal per Train Mile.
New York, New Haven, and Hartford	61,379	2,462,000	49
Old Colony	46,906	2,466,000	38
Albany and Susquehanna	46,425	1,175,000	79
Baltimore and Ohio	328,280	13,490,000	48
Delaware, Lackawanna, and Western Railroads	155,500	8,419,000	37
Lake Shore and Michigan	394,621	13,051,000	60
New York, Lake Erie, and Western	520,314	14,293,000	73
New York Central and Hudson River	700,000	22,222,000	63
Pennsylvania	635,000	24,941,000	51
Philadelphia and Reading	412,000	11,103,000	74
Pittsburg, Fort Wayne, and Chicago	273,000	8,117,000	43
Chicago and Alton	214,000	5,510,000	78
Union Pacific	428,000	4,929,000	174
Missouri Pacific	152,000	2,723,000	112
Totals and average	4,367,425	134,901,000	65

It will be observed that nine railways out of the fourteen tabulated show an average consumption of over 50 lbs. of fuel per engine mile. This is a much higher average than that found for the United Kingdom, where the consumpt of about 50 lbs., which has occurred on the Caledonian system, is regarded as an extremely exceptional figure. Even so well managed a road as the Pennsylvania shows a higher average than the most extravagant of our British railways; but there is this to be said for the Pennsylvania line, that fully two-thirds of its total train mileage belong to goods and mineral trains. It is much the same with the Philadelphia and Reading line, which, however, instead of keeping down to the comparatively modest (for the United

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States) limit of 51 lbs., shows an average of 74 lbs. per train mile. But that high fuel consumption is not always a function of heavy goods traffic is shown by the experience of the Delaware, Lackawanna, and Western Railways, which, with 77 per cent. of their traffic as either goods or minerals, have averaged only 37 lbs. of coal per train mile, being exactly one-half of the quantity recorded for the Philadelphia and Reading line, which has by no means an equally high proportion of the heavier description of traffic.

The United States have the command of the cheapest fuel in the world, as regards certain districts; but in other localities, remote from coal-fields, the cost of fuel is exceptionally high. As examples of the great variations that are found in this regard, it may suffice to mention that in the Census Reports for 1880 some lines return the average cost of their fuel—bituminous coal—at 60 cents (2s. 6d.) per ton, while others paid as much as 7 dollars (28s.) per ton for coal of practically the same description. The principal lines, however, appear to have their fuel supplies quite as cheaply as those of England. The Pennsylvania Railway, for instance, returns the average cost of its anthracite and bituminous coal consumption in 1880 at 1 dollar 20 cents (4s. 10d.) per ton. The Pittsburg, Fort Wayne, and Chicago returned the cost of its fuel, which was almost entirely bituminous coal, at 1 dollar 70 cents (6s. 10d.) per ton, and the New York Central paid as much as 3 dollars (12s.) for the bulk of its supply. There are, however, many lines that have purchased their supplies at less than a dollar per ton. The highest-priced fuel in the whole country appears to have been the bituminous coal bought from Wyoming territory by the Nevada County railways at 12 dollars (48s.) per ton, and the next most expensive was that bought in British Columbia at 8 dollars 26 cents (33s. 0½d.) by the Southern Pacific line.

In the United Kingdom there is almost as great a range of prices in locomotive fuel as in the United States. The

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cheapest fuel that we have found in our analysis of British lines is that bought by the Caledonian Railway Company for 4s. 2¼d. per ton; the dearest, that purchased by the North London Railway Company at 17s. 7¾d. per ton. It is probable that although there must be a few very remote localities in America where the cost of fuel runs very high, it can be purchased, as a rule, quite as cheaply in the United States as in our own country, and in some cases for less than the lowest prices quoted in England.

Notwithstanding these facts, however, the *average* cost of locomotive fuel in the United States, per train-mile run, is much higher than it is in our own country. This is a point that admits of no dispute, since it can be solved by returns that are not to be gainsaid. We have already seen that in the United Kingdom the average cost of fuel per train-mile amounted in 1883 to 1.7d. on the London and North-Western Railway, and to 1.6d. on the Great Western. These two lines pay what may fairly be described as an average price for their fuel, and are in other respects typical of fully two-thirds of the locomotive experience of the United Kingdom. But in the United States, according to the Census Report for 1880, the average cost of locomotive fuel per train-mile amounted to not less than 3.4d., being exactly double the price shown to be the average for our two chief British railways.[1] The source whence these figures were derived does not make it clear whether this enormous difference against the United States is chiefly attributable to the higher average consumption or the higher average price of fuel; but however it may be with reference to these two points, it should never be forgotten that the invariable practice in that country is to have heavier train loads than in our own; and if it were to be ascertained that the American average train-load is as much again as the English, the result

[1] The total cost of fuel for locomotive purposes in the United States was 32,836,470 dollars, which, divided by 465,341,000, the total number of train miles, gives, as above, an average of 3.4d. per train mile.

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would not, after all; be so unfavourable to American lines.

Before dismissing this subject, it is interesting to observe that on the Indian railways there are to be found differences in fuel consumption almost as extreme as those that we have discovered to apply to the United States, as the following official table shows:—

Statement showing the Description, Quantity, and Cost of the Fuel used on Indian Railways per Train-Mile in 1882.

Railways.	Description of Fuel.	Per Train Mile.	
		Consumption.	Cost.
		lbs.	s.
East Indian	Bengal	50.72	0.79
South Indian	English	27.01	3.11
Great India Peninsula	English and Bengal	45.03	4.19
Eastern Bengal	Bengal	55.30	3.34
Oudh and Rohilcund	Bengal	45.26	3.80
Punjaub Northern	Bengal (and Wood)	38.61	7.99
Wardha Coal	Warora	104.00	4.00
Calcutta and South-Eastern	Bengal	63.34	4.32
Northern Bengal	Bengal	31.84	2.69
Rangoon and Irrawaddy	English	20.36	2.41
Gaekwar of Baroda's	English	18.55	3.16
Nizam's	Wood	79.28	2.44

It needs no expert in locomotive practice to pronounce that some of the Indian coal is not at all suited to locomotive use, so far as the quantity consumed affects the problem. Where English coal is used, the consumption falls below the English average, which is quite what we might expect, considering the lighter character of the traffic, and the necessity for economising fuel acquired at such a considerable cost.

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CHAPTER XI.

EXPENDITURE ON PERMANENT WAY.

THE working expenses of a railway are principally made up of three items, which, in the order of their importance, as regards the United Kingdom, are—

1. Traffic charges,
2. Locomotive power, and
3. Maintenance of way.

Each of these, in its turn, is subdivided into a number of other items.

In regard to permanent way, the principal items of this subdivision are—

(*a.*) Wages.
(*b.*) Materials.
(*c.*) Ballasting.
(*d.*) Bridges.
(*e.*) Stations.
(*f.*) Other expenses.

Of the sum of these six items, wages and materials generally represent from 55 to 70 per cent.[1]

There is no department of railway expenditure that has shown a more remarkable economy within recent years than that of the maintenance and renewal of the permanent way. This economy is mainly due to the very

[1] In the case of the London and North-Western, they represented 54 per cent. for the ten years ended 1885. On the Great Western, over the same period, they formed 66 per cent. of the whole.

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greatly reduced cost of permanent way materials, and also, presumably, to the greater endurance of steel rails, with which most of the railway lines in the United Kingdom are now furnished.

The economy may be tested in either of two ways—

1. The expenditure per train mile.
2. The expenditure per open mile of railway.

The following are the items of expenditure per train mile in each division of the United Kingdom for the two years 1875 and 1884:—

Countries.	1875.	1884.	Percentage of Decrease in 1884.
	d.	d.	
England and Wales .	7.35	5.72	22
Scotland . . .	7.35	5.52	25
Ireland . . .	10.45	8.50	19
United Kingdom .	7.49	5.82	22

In the expenditure per open mile of railway, the figures have varied, as between the two periods, in the following manner:—

Countries.	1875.	1884.	Percentage of Decrease in 1884.
England and Wales .	£454	£409	10
Scotland . . .	286	245	14
Ireland . . .	194	166	14
United Kingdom .	393	350	10

It appears from these returns that, relatively to the amount of traffic, or work actually performed, the

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economy has been greater than it seems to be when tested by the mileage standard alone.

But in order to a correct and adequate appreciation of the extent and precise character of this economy, it is necessary to resolve into its several component particulars, the item that we have hitherto dealt with as permanent way expenditure.

In attempting this analysis, we shall deal with five typical railways only, believing that these will furnish the most satisfactory means of enabling the true position of the case to be apprehended. Those five lines are—

1. The Great Western.
2. The London and North-Western.
3. The North-Eastern.
4. The Midland.
5. The Great Northern.

With a total length of 8160 miles in operation, these five railways comprise about 60 per cent. of the total railway mileage of England and Wales, and much more than 60 per cent. of the total traffic.

Per train mile, the expenditure incurred for maintenance of way on each of these railways, in the years already tabulated, was—

Railways.	1875.	1884.	Decrease in 1884.	
			Amount.	Percentage.
	d.	*d.*	*d.*	
Great Western	7.77	6.90	.87	11
London and North-Western .	7.57	6.07	1.50	20
North-Eastern	7.96	6.19	1.77	22
Midland	6.95	4.48	2.47	35
Great Northern	6.54	4.60	1.94	29

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The diminution of expenditure has thus been very far from uniform, ranging from only 8.7d. per train mile in the case of the Great Western to 2.47d. in the case of the Midland. This great variation appears to call for some explanation that does not lie quite on the surface of the facts. It is probably to be found in the earlier adoption of steel rails by the Midland Company, and the consequent more complete realisation of whatever reduction of annual expenditure is attributable to that source.

It is mainly in the cost of material that the economy to which we have called attention has chiefly been attained. The expenditure per open mile in each of the years 1876 and 1885, on each of the lines dealt with, is shown in the next table:—

Statement showing the Expenditure for Permanent Way Materials on Leading English Railways in 1876 and 1885.

Railways.	1876.			1885.		
	Miles Maintained.	Cost of Materials.	Average per Mile.	Miles Maintained.	Cost of Materials.	Average per Mile.
		£			£	
Great Western.	2,004	405,727	202	2,327	225,799	97
London and North-Western	1,540	345,207	224	1,716	163,092	95
North-Eastern.	1,402	269,916	193	1,535	147,699	96
Midland	1,155	219,514	190	1,402	119,963	86
Great Northern	1,013	125,905	124	1,180	61,589	52
Totals and averages	7,114	1,366,269	192	8,160	718,142	88

The economy here is most striking, amounting as it does to an average of £104, or 118 per cent. per mile of line open. At the same rate of reduction, the economy resulting from this source in the total railway mileage open in the United Kingdom in 1885 should be approximately close on two millions sterling per annum.

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It is, of course, possible that the expenditure on materials for renewals, &c., was abnormally high in 1876, and abnormally low in 1885. It is, therefore, important to take into account the average annual expenditure on this score over the whole period of ten years, which was as under:—

Statement showing the Expenditure in respect of Maintenance and Renewal of Permanent Way on the Several Railways specified for the Ten Years ended 31st December 1885.

Railways.	Average Miles Maintained.	Average Annual Expenditure on Materials.	Average Annual Expenditure per Mile.
Great Western	2,155	£305,365	£141
London and North-Western .	1,648	228,005	138
North-Eastern	1,472	189,830	129
Midland	1,330	155,466	117
Great Northern	1,135	84,920	75
Totals and average . .	7,740	£963,586	£124

According to this showing, the average annual cost incurred in respect of materials of construction over the ten years was £68 less than the average of 1876, and £36 more than that of 1884, per mile open.

Wages are the next principal item in the maintenance of way account, representing, in the specific case of the Great Western, 29 per cent. of the whole, as compared with 37 per cent. in respect of materials. There has not, however, been the same great reduction in the cost of wages as in the expenditure for materials, although wages are largely a function of the life of the permanent way. The following statement shows the wages cost incurred in 1876 and 1885:—

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Railways.	1876.			1885.		
	Miles Maintained.	Wages Paid for Maintenance of Way.	Average per Mile.	Miles Maintained.	Wages Paid for Maintenance of Way.	Average per Mile.
		£	£		£	£
Great Western .	2,004	254,208	122	2,327	237,455	102
London and North-Western .	1,540	263,432	173	1,716	274,591	159
North-Eastern .	1,402	205,171	188	1,535	188,154	122
Midland . . .	1,155	208,297	180	1,402	200,917	143
Great Northern .	1,013	76,871	76	1,180	91,617	78
Totals and averages	7,114	1,007,979	142	8,160	992,734	121

We have here to deal with an average reduction of £21 per mile maintained, as compared with an average of £104 in the cost of materials. Distributed in the same ratio on the whole railway mileage of the United Kingdom, the reduction of wages expenditure as between 1876 and 1885 would amount to a further sum of £394,000. This figure is considerably above that which Mr. Price Williams calculated in 1879,[1] but it is not safe to assume that the saving will be uniformly as great over the whole of the country as on the five lines above tabulated.[2]

There does not appear to be much in the other items that enter into the cost of maintenance of way to call for special remark. Station repairs and renewals, as might be expected, are a constantly increasing quantity. This is a necessity apparently entailed by the demands of a greatly increased and increasing traffic, and by the more *exigeant* demands of the public, who do not now tolerate the accommodation that would have been borne without complaint a few years ago. Still, as the item of station repairs, &c., is only about 7 per cent. of the total expenditure

[1] "On the Economy of Railway Working," *Proc. I. M. E.*, Jan. 1879, p. 101.

[2] There is still a considerable mileage in out-of-the-way districts that has not been laid with steel rails.

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incurred in respect of maintenance of way, it does not greatly affect the general result.

The item which is vaguely classified as "other expenses," appears to show remarkable variations as between one company and another. In the case of the Midland it only amounted to an average of £2 per open mile in 1885, against an average of £104 in the case of the London and North-Western. Again, on the other leading lines this item appears to have considerably diminished, both absolutely and relatively, as between 1876 and 1885, but in the case of the Great Western, it mounted from £7 to £49 per mile open, as the following figures show:—

Railways.	1876.			1885.		
	Miles Maintained.	Total Expenditure.	Average per Mile.	Miles Maintained.	Total Expenditure.	Average per Mile.
		£			£	
Great Western .	2,004	13,400	7	2,327	115,629	49
London and North-Western .	1,540	187,451	122	1,716	177,745	104
North-Eastern .	1,402	48,008	34	1,535	23,291	15
Midland . . .	1,155	2,489	2	1,402	2,169	2
Great Northern .	1,013	4,524	4	1,180	3,102	3
Totals and averages	7,114	255,872	36	8,160	321,936	39

In bringing to a focus the several items that compose the maintenance of way expenditure, we are naturally struck with the differences that appear as between one line and another, the average outlay over the whole having, in the case of the North-Eastern, fallen from £562 to £367, or £195 per mile, as between 1876 and 1885, while in the case of the Great Northern, the decrease only amounted to £57 per mile. The average over the whole of the five railways dealt with was £522 in 1876, and

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£386 in 1885, being £136 per mile open, or 26 per cent. The details are given in the following summary table :—

Railways.	1876.			1885.		
	Miles Maintained.	Total Expenditure.	Average per Mile.	Miles Maintained.	Total Expenditure.	Average per Mile.
		£			£	
Great Western .	2,004	943,513	471	2,327	827,693	356
London and North-Western .	1,540	1,028,228	668	1,716	894,694	521
North-Eastern .	1,402	787,283	562	1,535	564,079	367
Midland . . .	1,155	652,857	565	1,402	579,368	413
Great Northern .	1,013	300,939	297	1,180	283,300	240
Totals and averages	7,114	3,712,820	522	8,160	3,149,134	386

It is almost worth the while of those immediately concerned to inquire how it happens that on the London and North-Western and Great Western Railways, the expenditure in respect of wages on permanent way account was identical, namely, 29 per cent., whereas materials represented 25 per cent. of the whole in the case of the London and North-Western, and 37 per cent. of the whole in the case of the Great Western, for the same period. Presumably the Great Western pays more for its materials or less for its labour than the London and North-Western; but it is by no means obvious why this should be the case.

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CHAPTER XII.

THE TAXATION OF RAILWAYS.

RAILWAY taxation may be divided into the three distinct categories of passenger duty, imperial burdens, and local or municipal imposts.

Under the old system of stage-coach travelling in England, the law imposed a tax of one penny per mile on every coach licensed to carry not more than four passengers, and of three-halfpence per mile on every coach not carrying more than six passengers, with an additional halfpenny for every additional three passengers. The principle of levying the tax was that of the capacity of the coach, the tax being levied equally whether the number of passengers in question was carried or not.

Under 2 & 3 Will. IV., c. 120, it was provided that railway companies should be taxed at the rate of one halfpenny per mile for every four passengers carried. The tax in this case was imposed, not upon the capacity of the carriages, but upon the number actually carried, which was a very different and much more equitable method of adjustment. The system of levying one-eighth of a penny per passenger per mile was, however, objected to very strongly on several grounds.

The first and most obvious was, that the incidence of the tax was unequal as between the different classes of passengers, the poor traveller, who paid to the railway company a less fare than the rich one, being required to pay the same duty to the Government. The next objec-

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tion was a consequent of the first, viz., that the incidence of the duty prevented railway companies from reducing the fares in the interest of poorer passengers. To obviate these objections, it was proposed, on behalf of some companies, that the duty should be a percentage on the gross passenger receipts. Upon this subject, the Select Committee of 1839 examined several witnesses, and reported thereafter that "there would be considerable difficulty in fixing upon a percentage which would produce the same amount of revenue; and it would also be in the power of any railway company to lessen the gross income derived from passengers, without reducing their profits." As an example of this, the Committee mentioned that railway companies would find it to their interest to reduce the fares of passengers, which were subject to duty, and increase the charge made for passengers' luggage, which was not so subject, if the duty were to be based upon gross income as such.

By the 52nd section of the Act providing for the taxation of passenger fares, the Board of Treasury was empowered to compound with railway companies for any sum of money less than the amount of duties chargeable under the Act in lieu of such duties. This power was for a time exercised rather largely, especially in the North of England and in Scotland, with the result that very much less than the full amount of the duties was obtained in many instances. The Select Committee of 1839[1] stated that these compositions were determined generally, "after a review of the peculiar circumstances of each case, and of the propriety of each individual application," without regard to a general principle. These compositions had been entered into for three years, and in some cases had then terminated, while in others they had been renewed, though not upon terms so favourable to the railways.

The Railway Passenger Duty has been modified or affected by several subsequent Acts of Parliament. The

[1] Select Committee's Second Report, p. xiv.

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Cheap Trains Act, which made it obligatory on all companies to run one train at least each way on every week-day, except Christmas Day and Good Friday, to provide for the conveyance of third-class passengers, to and from the terminal, and other ordinary passenger stations of the railway,[1] imposed a maximum fare of a penny per mile, an average speed of not less than twelve miles per hour, including stoppages, and the free transport of 56 lbs. weight of luggage for each passenger.

Under this Act, as modified subsequently by "The Farthings Act," [2] the railway companies made claims for exemption from passenger duty, which has been allowed by the Inland Revenue Department in respect of fares charged at a penny a mile and under.

It is a singularly cogent example of the way in which matters of great public concern are frequently managed (or mismanaged) in England, that for twenty-two years no attempt was made to obtain an authoritative legal decision on the point of whether this exemption was properly allowed or not.

In 1874, a decision was given by the House of Lords, which set aside the exemption, and led a number of companies, who had power under their Acts to do so, to charge the duty in addition to the fares, thus pressing with undue severity upon the poorer class of travellers.

In 1876, a Select Committee of the House of Commons was appointed to inquire into and report upon the law relating to the railway passenger duty.

In a comprehensive report, made in June of that year, the Committee announced their recommendations to be as follows:—

"(1.) That the tax is an undesirable one to maintain longer than is necessary from a fiscal point of

[1] 7 & 8 Vic. c. 85 (1844).
[2] 21 & 22 Vic. c. 75 (1858).

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view, and they recommend its repeal whenever the state of the public revenue will permit.

"(2.) That until the finances of the State warrant the abolition of the tax the following modification should be substituted; that the present tax of 5 per cent. be restricted to fares over 1d. per mile, and that the fares of all classes of passengers for the single journey carried in any train paying 1d. or less per mile be exempted, and that this exemption should apply to return, weekly, and season tickets; that in levying the duty in respect of return tickets, of whatever class, and by whatever trains the holders may be carried, one-half of the amounts be treated as the fare in one direction, and the other half as the fare for the return journey; that in levying the duty in respect of season tickets of whatever class, or whether the holders have been carried by express or stopping trains, the fare for each journey shall be reckoned by dividing the cost of the ticket by double the number of week-days in the period during which the ticket is available.

"(3.) That in urban and suburban districts all fares of all classes up to and including 9d., and all return fares based upon the fare for the single journey, be exempted.

"(4.) That in any future legislation care should be taken to keep in view the object that was aimed at by the legislative obligation to maintain ample communication between the several stations on each line."

The duty, although still in operation, is limited to other than Government fares, and Ireland is entirely exempted from it. The amount raised under the Act in 1884 was £398,577, which was 1.6 per cent. on the total gross sum

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derived from passenger traffic in Great Britain. It certainly does not seem worth the while of Parliament to continue an impost that yields so little to the revenue, and is so peculiarly obnoxious to the railway companies, as being not only a tax upon locomotion, which they regard as an article of primary necessity, but as being also differential in its character and incidence, inasmuch as all corresponding taxes upon competitive modes of locomotion have either been repealed or reduced to a minimum.

In addition to the railway passenger duty, railway companies are liable to heavy burdens in the form of general and local rates and taxes.

It is often put forward by railway companies as a good reason for the maintenance of high rates of transport, that they are taxed and rated much more heavily than formerly, and that they require a larger margin to meet such increase of expenditure. It is an easy matter to bring this question to the test of actual facts.

The amount of rates, taxes, and Government duty paid per open mile of railway in the United Kingdom rose from £95 in 1870 to £119 in 1875, and £129 in 1880. It fell to £124 in 1884. There is an increase between the first and the last year of the series of £29, or 30 per cent. But this is not, after all, the correct method of estimating the difference, which should be calculated in reference to the traffic carried and the receipts accruing therefrom. In 1870 the traffic carried on the railways of the United Kingdom was 169 millions of tons, being about 11,000 tons per mile; in 1884 the total traffic carried was about 259 millions of tons, or about 14,000 tons per mile. In 1870 the gross receipts per mile open were £2794; in 1884 they amounted to £3589, or 25 per cent. more. It appears, therefore, that while the rates and taxes have increased by 30 per cent., the receipts have increased by 25 per cent. per mile open, leaving the one nearly balanced by the other.

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Statement showing the Incidence of Taxation per Train Mile on the principal British Railways in 1874 and 1884.

Railways.	Rates, Taxes, &c., per Train Mile in		Increase or Decrease in 1884.	Percentage of Increase or Decrease in 1884.
	1874.	1884.		
	d.	*d.*	*d.*	per cent.
Caledonian	1.52	1.65	+ 0.13	9
Great Eastern	2.43	1.93	− 0.50	21
Great Northern	1.90	1.81	− 0.09	50
Great Western	2.08	2.23	+ 0.15	7
Great Southern and Western of Ireland	2.33	2.49	+ 0.16	7
Lancashire and Yorkshire	2.02	2.12	+ 0.10	5
London and North-Western	1.95	1.88	− 0.07	4
London and South-Western	2.95	2.51	− 0.44	15
London, Brighton, and South Coast	3.76	3.48	− 0.28	7
Manchester, Sheffield, and Lincoln	1.72	1.80	+ 0.08	5
Midland	1.65	1.50	− 0.15	9
North-Eastern	1.91	1.96	+ 0.05	3
South-Eastern	5.75	4.22	− 1.53	27

According to this showing, the amount paid per train mile—which is really the best test to apply, since the train-mile standard affords the best idea of the amount of the traffic, actual or possible—has declined on seven lines, and increased on six others, as between 1874 and 1884. The most striking cases of decreased taxation are those of the South-Eastern and the Great Eastern, two lines that are almost entirely dependent upon their passenger traffic.

One point which was brought forward by railway companies before the Commission of 1867 as laying a heavy burden upon them, and thus acting as a prohibition to reduce their charges, is, that the railways, whilst they are not in many cases a source of increase to the rates, are taxed for local purposes to a higher amount than any other kind of property; that the existing mode of ascertaining the assessable value leads practically to the assessment of profits of trade, and stock in trade; and that the system is vexatious, difficult, and uncertain in

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operation, and creates inequalities which do not usually attach to the assessment of any other kind of property.

The general principle upon which railways should be rated was stated by the Commission to be a clear one, viz., to take the net annual value of the land, as improved in the hands of the railway company by the construction of the line, stations, and other works, without reference to their profits as carriers; that is, to take the rent which would be paid by a tenant to whom the line might be leased. When it is attempted to apply this principle in practice, though it appears to be simple, great difficulties arise. One of the difficulties is, that most sorts of rateable property lie exclusively within the parish which makes the rate; for example, houses or farms, or a manufactory or a coal-mine, which are the ordinary objects of rating, usually lie within the parish in which the rate is made, and the assessing authority has only to consider what the probable net annual value of such occupation may be. If the occupation should be of property in several parishes, it is not difficult to value the property in each parish separately. But with regard to a railway which passes through a long succession of parishes, the person making the assessment cannot ascertain what amount of traffic passes over the section of the railway within the parish; he must consider what would be the probable letting value of the entire line, and he must then take such proportion of that entire value as falls within the particular parish. There is also a further complication arising from buildings, or stations, being unequally distributed in the parishes in which the railway is situated; thus in some cases there is a station in the parish, and in others there is not, which adds to the difficulty of making a fair assessment upon the railway. The authority in each parish or union makes the assessment without reference to the assessment in other parishes or unions. When the railway passes through numerous parishes or unions in succession, each parish or union is entitled to make its own assessment, without any reference whatever

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to the aggregate that would be produced by adding together the rates of the different parishes or unions.

If the rates were made fairly, by adding up the assessments in all the different parishes or unions through which the line passes, the total annual value of the railway for purposes of assessment ought to be obtained; but the authorities do not, for the most part, proceed from any total. They merely form a conjecture as to the probable amount of value which belongs to that part of the railway which is in their parish. This has, no doubt, led to anomalous results.

The net income of the railway companies in England in 1864 was 16 millions sterling, after paying all outgoings except rates, taxes, and Government duty. The local rates paid by them for that year amounted to £527,123, or $3\frac{1}{8}$ per cent. For the same year the local charges in England upon the income derived from landed property amounted to about 11 per cent., exclusive of the profits of farmers or other occupants using landed property for industrial purposes.

Under the Act 21 & 22 Vic., c. 98, railways are to be assessed for rates levied under the Public Health Act, and for the local government of towns, in the proportion of one-fourth part only of the net annual value thereof. Only a portion of railway earnings was regarded as derived from the occupation of railways and stations, and the remainder has been left untaxed as the profits of their business.

The Duke of Devonshire's Commission recommended that the Poor Law Board, or some other public authority, should make an assessment for rating the whole railway, and then divide the amount according to an equitable principle between the several unions or parishes.

The incidence of taxation in reference to railway property varies considerably as between the several divisions of the United Kingdom. Relatively to gross railway income, it is highest in Ireland and lowest in Scotland.

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The figures for each of the three countries in 1884 were as under:—

Countries.	Rates and Taxes.	Gross Receipts.	Percentage of Taxation on Gross Receipts.
	£	£	
England	1,664,660	60,099,011	2.7
Scotland	187,997	7,595,391	2.5
Ireland	85,034	2,828,241	2.9
Totals and average .	1,937,691	70,522,643	2.7

The railways of the United Kingdom are not alone in their liability to taxation. The same fate befalls the railways of nearly every other country, although the returns of the amount of taxation levied are not in all cases so specifically set out as in the case of British lines. The following figures, however, show the amounts of taxation paid both absolutely and relatively to gross earnings, in the United States, in the Census year 1880:—

Countries	Gross Earnings of all Railways in 1880 (1 dol. = 1000).	Total Taxation, State and Municipal (1 dol. = 1000).	Percentage of Taxation on Gross Income.
	$	$	
New England States . .	46,942	1,601	3.4
Middle States . . .	283,173	5,945	2.1
Southern States . . .	49,172	616	1.3
Western States . . .	130,608	3,267	2.5
Pacific States	70,554	1,855	2.6
Totals . .	580,450	13,284	2.3

It therefore appears that the highest taxation is levied on railway property in the New England States, and the lowest in the Southern States. In the former the taxation is higher relatively to income than in Great Britain. In the Middle States, which embrace New York, Pennsylvania, Ohio, and Maryland, the average taxation amounts to 2.1 of the gross railway income, which is .6 per cent.

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under the average of the United Kingdom. Taking the United States as a whole, it appears that the taxation of the railway interest, relatively to its gross income, is .4 per cent. under the average of the United Kingdom.

There has been a good deal of agitation in the United States, and not a little dissatisfaction on the part of the public, in consequence of the failure of a number of leading railway companies to obtain patents for lands that have been granted to them by the State for constructive purposes. As examples, it may be stated that, at the end of 1882, the following lands were granted and patented respectively:—

Railways.	Lands Granted.	Lands Patented.
	Acres.	Acres.
Union Pacific	12,000,000	2,000,000
Central Pacific. . . .	8,000,000	1,000,000
Western Pacific . . .	1,000,000	500,000
Kansas Pacific. . . .	4,000,000	1,000,000
Denver Pacific. . . .	1,000,000	50,000
Totals . .	26,000,000	4,550,000

Only about 17 per cent., therefore, of the lands granted to these companies have been patented, which means that only that proportion has become liable to taxation by State, territorial, or municipal authorities. In other words, the companies permit these lands to grow valuable by lapse of time and the sentiment of the country, without contributing to the maintenance of the public authority, or of the common institutions of municipal organisation by the aid of which such enhanced values are secured, so that this burden is thrown upon the legal owners of a moiety of the lands embraced within the limits of the railroad grants. This flagrant dereliction of obvious obligations on the part of the railways in question has recently been under the consideration of Congress.

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In practically every European country, as in Great Britain, the railway interest is subjected to local and imperial burdens, which vary according to the methods of taxation in operation and the manner of its incidence.

Perhaps the most heavily burdened of all Continental railway systems is that of Italy, where the Government levy a stamp duty on every passenger ticket, which, on short journeys, is equal to an imposition of about 12 per cent. on the cost of third-class traffic. There is, besides, an impost of about 13 per cent. on goods traffic at high velocity; so that the two items together represent an impost of 25 per cent. for short distances, and thus compel the maintenance of exceptionally high fares.[1]

Under section 38 of the General Railway Code of Prussia (1838), it is provided that railways should pay a duty to be graduated in proportion to the profits on the total capital subscribed, after deducting all the expenses of repair, the cost of carrying on the business, and the yearly sum to be appropriated to the reserved fund. The amount of this duty was not to be fixed, however, until the second railway opened in Prussia should have been in operation for three years. Until then, it is naïvely remarked, that "the loss which the Post-Office revenue will evidently sustain through the railroads is to be compensated for by the services to be performed by the railways in its favour."[2] Railways were, under the same code, exempted from trade taxes; and it was specifically provided that the proceeds of the graduated duty, referred to above, should only be applied to indemnify the State for the loss of revenue occasioned by the railroads, and the redemption of the capital employed in the undertaking.

Again, there is payable to the State by the Prussian Railways, an income-tax or duty upon the net profit on

[1] "Giornale dei Lavori Pubblici e delle Strade Fedrate," an. vii. p. 73.

[2] The services included the gratuitous transport of letters, cash remittances, post wagons, &c., and persons furnished with post-free passes.

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the share capital, after deducting management, maintenance, working expenses, reserve and renewal funds, as well as interest and sinking funds to pay off loans, before striking the dividend, upon the following rising scale, viz. :—

When the net profit amounts to			4 per cent.,	.	.	$\frac{1}{10}$ thereof
,,	,,	,,	over 4 to 5	per cent.		$\frac{1}{20}$,,
,,	,,	,,	,, 5 to 6	,,		$\frac{1}{10}$,,
,,	,,	,,	,, 6	,,		$\frac{2}{10}$,,

This income-tax is to be applied by the State in buying in the open market the shares of the company which pays it, and the interest and dividends on these shares are to be applied in like manner, the shares themselves being taken for ever out of course and deposited in the national debt office of the State, and thus, by degrees, the share capital of the company becomes amortised.

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CHAPTER XIII.

THE DISTRIBUTION AND COST OF RAILWAY LABOUR.

In dealing with the subject of railway economy, there is perhaps no phase that has received from statisticians and economists so limited an amount of attention, relatively to its importance, as that of the results of railway working in reference to the numbers employed.

There has, in truth, been a lack of definite statistical information upon this subject until quite lately. There is now, however, at command a sufficient range of facts to enable us to inquire into the more prominent bearings of the *personnel* upon the the character of railway administration in all the leading countries of the world.[1]

There is probably no other single industry that gives employment to so large a number in the principal countries of the world, regarded as a whole, as that of railway working, unless it be that of agriculture. In the United Kingdom, where the railway system as a whole found direct employment in 1884 for 367,793 persons,[2] it will, of course, be found that both the textile and mining industries give direct employment to an even larger number. But if we consider how many thousands are employed in furnishing

[1] The *data* to be used in this chapter are obtained, in respect of the United Kingdom, from returns presented to the House of Commons, especially those of 1885; in respect of the United States, from the Census Reports; and in respect of European countries, from the "Statistique de chemin de fer."

[2] According to a return presented to Parliament on the motion of Mr. Broadhurst.

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railway *matériel*, in addition to those directly employed in railway working—in building locomotives, manufacturing rails, chairs, and sleepers, furnishing stores and fuel, and in a thousand other ways—it will probably turn out that railways, as a source of human employment, are, even in an industrial and manufacturing country like our own, superior to all other sources whatsoever.

This is still more strikingly the case in the United States. In that country the numbers engaged in railway operations can only be ascertained for census years, and therefore we are without any reliable information for a later date than 1880. But in that year the American railway system furnished direct employment to 418,957 persons, being an average of nearly five persons to each mile of line open. If the same relation of *employés* to mileage is assumed for 1886, the railways of the United States would employ at the present time not less than 630,000 workers of all kinds, which is a very much larger number than any other occupation employs, except agriculture.[1]

So far as the *data* available enable an estimate to be framed, the total number of *employés* engaged in railway working in Europe and the United States of America was, in 1884, about as under:—

United Kingdom . . .	367,793,	or 19.69	per mile open
United States . . .	630,000,	„ 4.77	„ „
Continental countries . .	1,076,649,	„ 13.6	„ „

This gives a total of 2,074,442 *employés* of all kinds, to which a few thousands more will require to be added for Scandinavian countries, that are not included in the European total.

If we divide into this number the total mileage constructed in the several countries to which it applies—that is, 227,450 miles—we shall find that the average number

[1] The next most important industries in the United States are those of cotton, which employed 185,472 hands in 1880, and iron and steel, which in the same year found employment for 140,978 hands.

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of *employés* per mile of line open throughout Europe and the United States is about 9.1, or less than one-half the average of the United Kingdom.

There must clearly be some good reason for this remarkable difference, by increase, on English railways. At a later period of our inquiry we shall find that this explanation lies chiefly in the greater amount of traffic to be dealt with.

Another cause, specially applicable to the United States, will at once occur to those who have travelled in that country. There are comparatively few porters in America. There are nearly 50,000 in the United Kingdom. The system of dealing with passengers' luggage in the two countries is radically different, and tends to economy of labour in the United States. Whether the American system is better, all things considered, we shall not now stop to inquire.

In now proceeding to analyse the condition-of-labour question as it refers to railway working, we shall view the subject under two aspects—the first, that of the differences that distinguish English railways from one another; the second, that of the more prominent features of contrast as between different countries.

The first of these two subjects of inquiry may again be appropriately subdivided into the three several branches of—

(1.) The numbers employed relatively to open mileage and gross earnings.
(2.) The proportions of each description of *employés* relatively to the total on each line; and
(3.) The absolute increase or decrease of the cost of labour in relation to results.

The first of these three points is clearly illustrated in the following table:—

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Statement showing the Total Number of Employés *on the Principal Railways of the United Kingdom, with the relative Traffic, Mileage, and Earnings of each Railway in* 1884.

Railways.	Total Number of *Employés.*	Total Train Miles (1 = 1000).	Total Mileage Open.	Total Gross Earnings (£1 = 1000).	Average Number of *Employés*		
					Per 1000 Train Miles.	Per Mile of Line Open.	Per £1000 of Gross Earnings.
Great Eastern	20,003	13,820	1,049	£3,563	1.45	19.07	5.61
Great Northern	20,387	16,329	768	3,581	1.25	26.55	5.69
Great Western	39,547	30,346	2,268	7,993	1.30	17.44	4.95
Lancashire and Yorkshire	20,926	13,069	494	3,794	1.60	42.36	5.52
North-Eastern	33,284	24,445	1,534	6,856	1.36	21.70	4.85
South-Eastern	8,396	6,347	370	2,171	1.32	22.69	3.87
London and North-Western	55,061	38,326	1,793	10,530	1.44	30.71	5.23
London and South-Western	15,371	11,047	721	3,056	1.39	21.32	5.03
London, Brighton, and South Coast	9,827	7,949	403	22,45	1.24	24.38	4.38
London, Chatham, and Dover	5,275	3,831	160	1,253	1.38	32.97	4.21
Manchester, Sheffield, and Lincoln	10,951	6,528	314	2,041	1.68	34.88	5.37
Midland	43,699	33,087	1,381	7,434	1.32	31.64	5.88
Caledonian	14,140	11,850	877	3,064	1.19	16.12	4.61
North British	13,896	11,461	1,008	2,657	1.21	13.79	5.23
Glasgow and South-Western	5,743	4,525	332	1,338	1.27	17.30	4.30
Great Southern and Western of Ireland	4,550	2,844	478	755	1.60	9.52	6.03

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It will be observed that the variations in the number of *employés* per mile of line open are much more considerable than those in the numbers employed per £1000 of gross earnings. This circumstance may be held to establish two points—the first, that there are great differences in the gross earnings per mile as between one railway and another; and the next, that for this reason the mileage test is not a safe one to apply, since it is possible that on one line the amount of labour actually performed may be twice or three times that on another for the same open mileage.

If we examine more particularly the returns that refer to the North British Railway, we shall see how far this principle is carried in actual practice. On that line the number of *employés* per mile open is not one-third of the number employed on the Lancashire and Yorkshire line, and yet it will be noted that the labour employed per £1000 of gross earnings is approximately the same in both cases.

The lowest ratio of labour to gross earnings occurs on the South-Eastern line; the highest on the Great Western and Southern of Ireland. As both of these are mainly passenger-carrying lines, it is evident that no principle or law, calculated to establish the ratios that should be apportioned to passenger and goods traffic, respectively, can be deduced from the figures.

It is clear, then, that the relation of labour to results —whether the standard to be adopted should be gross earnings, net earnings, mileage open, tonnage and passengers carried, or some other leading factor—has still to be placed on a scientific basis. There does not appear to be any reason, on the face of it, why, on two lines that have so much in common, as regards their traffic and their geographical position, and the cost and efficiency of their labour, as the Great Northern and the North-Eastern Railways, it should require 5.69 *employés* to earn £1000 in the one case, and only 4.85 in the other;

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nor is it any more easily explicable why the Great Eastern should employ 5.61 hands to obtain the same result as the South-Eastern has arrived at with 3.87, remembering how much alike are the circumstances of the two lines. The matter is one that appears to be well worthy of a larger share of consideration from railway authorities.

The average number of *employés* per £1000 of gross earnings on the railways of the United Kingdom as a whole appears to be about 5.4.[1] It will be noted in the immediately preceding table that most of the principal lines are under this average, from which it would seem to follow that the poorer lines employ a considerably larger number of hands to realise the same financial results.

In the United States, the average number of railway *employés* per £1000 of gross earnings appears to have been rather over 2.8 in 1880, which, assuming that all the conditions of the comparison are relevant and parallel, would seem to show a very considerably higher revenue in relation to *employés* in that country.[2] In point of fact, it would appear as if, on American lines, it required only about one-half the number to earn £1000 that is found necessary on English railways. This, again, is a matter that would seem to invite very serious consideration on the part of those who are charged with the administration of English lines.

The next point to which we have undertaken to direct our inquiries is that of the proportions of each several description of railway *employés* relatively to the whole. With a view to elucidating this problem, the following statement has been compiled from returns of railway

[1] The total gross earnings in 1884 having been 67¾ millions sterling, and the number of *employés* 367,793.

[2] In the Census year 1880, 418,957 railway *employés* in the United States earned a total of 580½ million dollars, or about 146 millions sterling.

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labour presented to Parliament in each of the years 1860 and 1884:—

Statement showing the Proportions of each Description of the Personnel *of the Railways of the United Kingdom in* 1860 *and* 1884.

Description.	Number Employed in Year		Increase or Decrease in 1884.	Percentage of Total *Employés* in	
	1860.	1884.		1860.	1884.
Managers and secretaries	162	191	+ 29	0.15	0.05
Engineers	104	125	+ 21	0.10	0.03
Superintendents	283	143	− 140	0.27	0.04
Storekeepers	150	105	− 45	0.14	0.03
Accountants and cashiers	144	147	+ 3	0.13	0.04
Inspectors and timekeepers	856	3,518	+ 2,662	0.82	0.96
Station-masters	2,231	6,165	+ 3,934	2.15	1.68
Ticket-collectors	400	2,060	+ 1,660	0.39	0.56
Draughtsmen	158	248	+ 90	0.15	0.07
Agents	...	862	+ 862	...	0.23
Clerks	8,630	33,670	+25,040	8.31	9.15
Foremen	1,468	2,906	+ 1,438	1.41	0.79
Engine-drivers	3,221	12,874	+ 9,653	3.10	3.50
Firemen	3,291	12,795	+ 9,504	3.17	3.48
Guards	3,602	13,312	+ 9,710	3.47	3.62
Artisans	21,303	55,940	+34,637	20.51	15.21
Switchmen	3,762	19,012	+15,250	3.62	5.17
Gatekeepers	1,988	1,605	− 383	1.91	0.44
Policemen	2,135	1,781	− 354	2.06	0.48
Porters	16,178	44,617	+28,439	15.57	12.13
Plate-layers	6,358	29,820	+23,462	6.12	8.11
Labourers	25,069	70,405	+45,336	74.13	19.14
Goods managers	...	113	+ 113	...	0.03
Telegraphs	...	3,754	+ 3,754	...	1.02
Steam-boat service, &c.	...	6,041	+ 6,041	...	1.64
Canals	...	1,963	+ 1,963	...	0.53
Hotels and refreshment-rooms	...	2,518	+ 2,518	...	0.68
Miscellaneous	3,381	40,317	+36,936	3.25	10.96
Totals	103,874	367,793	+263,919	...	...

In this table there are several important lessons to be learned by those who care to undertake its analysis, and have the skill to read between the lines. It will be seen,

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to begin with, that there has been a remarkable reduction in the relative numbers of prominent and highly-paid officials, largely as a result of the amalgamation movement that has been in progress during the interval. This reduction applies more especially to superintendents, who have fallen from 0.27 per cent. to 0.04 per cent. of the whole *personnel*, but it is also conspicuous in the cases of managers and secretaries, engineers, storekeepers, and accountants. Clerks, on the contrary, have increased from 8.31 per cent. to 9.15 per cent. of the whole.

In reference to those classes of *employés* that are engaged in actually working the trains—engine-drivers, firemen, and guards—their percentage proportions have been little affected in the interval; but it is otherwise when we come to deal with manual and lower-class labour. Labourers, as such, have declined from 24.13 per cent. to 19.14 per cent., while artisans have fallen from 20.51 per cent. to 15.21 per cent., and porters from 15.57 per cent. to 12.13 per cent. Platelayers, on the contrary, have increased from 6.12 per cent. to 8.11 per cent., and switchmen from 3.62 per cent. to 5.17 per cent. The great diminution that has taken place in the number of level crossings appears to be reflected in the fact that gatekeepers have decreased from 1.91 to 0.44—a fall of over [illegible] per cent.; while it looks as if law and order were more easily maintained now than formerly, when we consider that policemen have declined from 2.06 per cent. to 0.48 per cent.—a decrease, again, of nearly 400 per cent.

The last point to which attention may suitably be called in this table is that of what we may describe as the minor and auxiliary departments of railway service. In the return for 1860, no separate records were made of the now considerable numbers engaged in telegraph, steamboat, canal, and hotel and refreshment-room service. In the 1884 return, however, each of these sources of employment is separately considered, and they tend to

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throw a curious kind of side-light upon the collateral aspects of our great carrying industry. That railway companies are also great carriers by sea is made abundantly evident by the fact that in this service they employ 6041 persons. We are without any record of the tonnage of steamships owned by English railways; but the Board of Trade returns show that in the merchant service generally one *employé* represents thirty-three tons of steam tonnage; and if the tonnage owned and worked by our railway interest were to be calculated at approximately the same rate, it would follow that they own not less than 199,353 tons in all. Since, however, a large proportion of the number returned as engaged in steamboat service is probably otherwise occupied than in the actual work of navigation, this calculation may be regarded as more curious than correct.

A very interesting commentary on the treatment which the railway interest bestows upon our inland navigation is furnished by the fact that they only employ 1963 hands in working upwards of 1700 miles of canals that have come into their possession. In other words, they allow an average of 13 to 40 *employés*—according to the extent and character of the traffic—for each mile of railway open, but they only give a fraction over one *employé* to each mile of canal. The cause and the effect are equally plain. Some railways have utterly neglected the canal traffic that has unfortunately come under their dominion, and have concentrated their energies on getting the traffic that would otherwise have been transported by, and is in its character essentially more suited for, canals on to their lines.

In looking into the question of railway labour in relation to results in the United Kingdom, there is one point that stands out very prominently, and demands a high degree of consideration. In 1860, the railways of the United Kingdom employed ten operatives of all kinds per mile of line open; in 1884, the number had risen to

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rather over 19 per mile open. In the interval, therefore, the relation of *employés* to mileage had just about doubled. The same tendency appears in the labour employed relatively to gross earnings, there having been 3.8 *employés* for every £1000 received in 1860, as compared with 5.4 in 1884. It is a matter of real concern that our railways should have had occasion to employ, in 1884, 40 per cent. more labour to earn £1000 than they did in 1860. This increase, be it remembered, has reference to numbers only, and not to wages, about which we may have something more to say by-and-bye. The plea of railway directors, in answer to this serious increase of working expenses, would no doubt be that it had been entailed very largely, if not almost entirely, by the provisions which the Legislature has from time to time imposed with a view to the greater security of the travelling public. We shall not at present stay to examine this reply; but it behoves both the railway interest and the public at large to see that it is adequate to the gravity of the fact.

With reference to the cost of labour—as distinguished from mere questions of comparative wages or earnings—we shall best elucidate this point by looking into the returns of some of our leading lines over a period sufficiently long to indicate the true course of events.

On the London and North-Western Railway, the total amount expended as salaries and wages in the coaching and police departments for the year 1876 was £399,542, and for the year 1884, £475,675. In the same period, the number of miles run by passenger trains had increased from 15,577,000 to 19,747,000 miles. The average wages cost per passenger train mile was, therefore, only 5.8d. in 1884, as compared with 6.1d. in 1876, being a reduction of about 5 per cent. In the merchandise department of the same railway, the amount expended in salaries and wages in 1876 was £697,188 for 17,006,000 train miles, being an average of 9.8d. per train mile. In 1884, the expenditure under the same head was £834,707, and the

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number of miles run by goods and mineral trains was 18,437,000, being an average of 10.8d. per train mile. It appears, therefore, that there has been an increase of about a penny per train mile in the goods, as compared with a decrease of only .3d. in the passenger department. This is not quite a satisfactory showing, and is all the less so considering how important a feature of the English railway returns goods and mineral traffic represents. The experience of the London and North-Western line is so fairly typical of that of the country generally that we need not further pursue this aspect of our inquiry.

From the Report of the Tenth Census of the United States, we have collated, under eleven different headings, the total number of railway *employés* in that country, and compared them, as far as comparison is practicable with two sets of figures that are not strictly parallel, with the same *data* for the United Kingdom in the table that follows. The result is remarkable. It does not, indeed, appear as if there are any two sets of figures in the whole table, except the first, that even approximately correspond, whereas most of the items are so widely divergent as to suggest that the items cannot in all, or even in the majority of cases, refer to the same elements. In a statement containing so many startling contrasts, we can hardly suggest any one that is more remarkable than the rest. If, however, we may mention the item that chiefly strikes our own mind, it is that of trackmen, of whom 6.47 appear to be employed per mile open in the United Kingdom, as against only 1.40 in the United States, indicating a very serious increase of difference in the maintenance of English railways, which, however, is doubtless a function of the greater traffic. It will probably also be noted with some surprise that conductors are absolutely more numerous in the United Kingdom than in America.

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Statement showing the Number of Employés *of Different Descriptions on the Railroads of the United Kingdom and the United States, respectively, in* 1880 (*miles open in United Kingdom,* 18,861; *in United States,* 87,782).

Description.	Total Numbers Employed in the		Numbers Employed per Mile of Railway Opened.	
	United Kingdom.	United States.	United Kingdom.	United States.
General officers . .	824	3,375	0.04	0.04
„ office clerks .	33,670	8,655	1.80	0.10
„ station-men .	64,901	63,380	3.47	0.72
Engineers . . .	...[1]	18,977	...	0.22
Conductors . . .	13,312	12,419	0.71	0.14
All other trainmen .	25,669	48,254	1.37	0.55
Machinists . . .	55,940	22,766	2.99	0.25
Carpenters . . .		23,202	...	0.26
All other shopmen . .	...	43,746	...	0.50
Trackmen . . .	120,842[2]	122,489	6.47	1.40
All other *employés* .	52,635	51,694	2.82	0.59
Totals . .	367,793	418,957	19.69	4.77

With a view to throwing additional light upon this subject, Mr. Findlay, of the London and North-Western Railway, has been good enough to have the *personnel* of that line classified for the author, as per the next statement, in order to allow of more ready comparison with that of the railways of the United States.

Employment.	United States Railways.	London and North-Western Railway.
	No.	No.
Permanent way	122,489	9,181
Running department . . .	79,650	7,625
Locomotive works . .	89,714	7,502
Carriage works . . .		2,903
Wagon works . . .		1,397
Joint lines	127,104	7,000
Various		3,633
Totals . .	418,957	59,815

[1] Included under "machinists."
[2] Platelayers, labourers, gatekeepers, and switchmen.

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This table cannot, however, claim to establish an exact comparison, since the figures that refer to the English railway embrace general officers, clerks, and station-men in each separate class, while in the United States returns, all of these are entered under the heading of "various," together with a residuum of 51,694 other *employés* of whom no specific details are afforded.

On the railways of India, which are, all things considered, perhaps the most economically managed in the world, the average number of *employés* of all kinds per mile open, in 1882, was 18.69, which is a much higher proportion, relatively to mileage, than that found for the United Kingdom, but still lower than that which obtains in the United States. The details are appended:—

Statement showing the Number of Employés *on the Railways of India on the 30th September* 1882 (9936 *miles*).

Departments.	Operatives.	Average Number per Mile.
Administration	11,625	1.17
Traffic and telegraph . . .	35,610	3.58
Engineers	85,068	8.56
Locomotive, carriage, and wagon	53,435	5.38
Totals . .	185,738	18.69

Of the above numbers, only 3796 were Europeans, the remainder being entirely natives.

It is now worth while to examine the relation of *employés* to mileage open in the different leading countries of Continental Europe. This, happily, is not a difficult investigation, since the railway returns of each European country embrace detailed statistics of the *personnel*, as divided into the two categories of salaried *employés* and daily wage-earners. The results for the year 1882 are as under:—

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Statement showing the Total Number of Employés *on the Railways of Continental Europe, and the Average per Mile of Line Open and per £1000 earned.*

Countries.	Salaried *Employés.*	Daily Wage-Earners.	Total *Employés.*	Miles Open.	Average *Employés.*	
					Per Mile Open.	Per £1000 Earned.
Germany .	131,093	172,898	303,991	21,910	14	6.3
Austria . .	54,753	98,082	152,835	12,151	13	6.6
Belgium .	8,257	37,804	46,061	2,090	22	7.1
Denmark .	2,112	4,405	6,517	1,005	6	8.9
France . .	158,948	84,044	242,992	17,684	14	5.4
Italy . .	46,836	24,857	71,693	5,693	13	8.7
Luxembourg .	118	610	728	92	8	...
Holland .	4,472	9,634	14,106	1,132	12	7.1
Roumania .	2,646	4,281	6,927	861	8	...
Russia . .	154,454	61,019	215,473	14,478	15	...
Switzerland .	9,380	5,946	15,326	1,673	9	5.0
Totals and average	573,069	503,580	1,076,649	78,769	13.6	...

On comparing these returns with those that we have already given in reference to the United Kingdom, Continental Europe, India, and the United States, the results come out as under:—

Countries.	Total *Employés.*	Average per Mile.
United Kingdom	367,793	19.69
United States	418,957	4.77
India	185,738	18.69
Continental Europe . . .	1,076,649	13.6
Grand total and average .	2,049,137	10.5

There is a very considerable amount of instruction as to the comparative conditions of railway administration in

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England and America to be got from a comparison of the numbers of *employés* on the leading lines of each country, relatively to the gross earnings. There is no question connected with railway working in which we shall find more signal and unaccountable variations than in this. The average gross earnings per *employé* on sixteen of the leading British lines appears to be £195; the net earnings come out as £93. On fifteen leading American lines, however, the average gross earnings per *employé* comes out as £320, or about 70 per cent. more than the average of the United Kingdom, while the net earnings per *employé* are £144, or about 53 per cent. higher. It would be interesting, if it were possible, to discover exactly how these differences arise. The particulars of the two series are appended:—

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Statement showing the Total Number of Employés *in the Service of each of the leading Railway Companies in the United Kingdom, and the Average per Mile Open and per £1000 Earned in 1884.*

Railways.	Total *Employés.*	Total Gross Earnings (£1 = 1000).	Net Earnings (£1 = 1000).	Average per *Employé.*	
				Gross Earnings.	Net Earnings.
Great Eastern	£20,003	£3,563	£1,569	£178	£78
Great Northern	20,387	3,581	1,572	179	79
Great Western	39,547	7,993	4,008	200	100
Lancashire and Yorkshire	20,926	3,794	1,685	181	80
London and North-Western	55,061	10,530	5,149	191	94
London and South-Western	15,371	3,056	1,256	204	84
Manchester, Sheffield, and Lincoln	10,951	2,041	1,023	186	93
Midland	43,699	7,434	3,551	169	81
London, Brighton, and South Coast	9,827	2,245	1,092	224	109
London, Chatham, and Dover	5,275	1,253	590	251	118
Metropolitan	1,685	665	389	395	231
North-Eastern	33,284	6,856	3,368	208	102
South-Eastern	8,896	2,171	1,119	241	124
Taff Vale	3,316	769	378	232	126
Caledonian	14,140	3,064	1,461	219	104
North British	13,896	2,657	1,294	190	92
Totals and averages	£316,264	£61,672	£29,504	£195	£93

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Statement showing the Total Number of Employés *on different leading Railways in the United States, relatively to the Gross and Net Earnings in* ~~1864~~ 1870

Railways.	Number of *Employés.*	Gross Earnings ($1 = 1000).	Net Earnings ($1 = 1000).	Average Earnings per *Employé.*	
				Gross.	Net.
		$	$	$	$
Pennsylvania.	25,736	37,860	15,706	1,456	604
New York Central	13,007	29,322	11,461	2,256	882
Lake Shore and Michigan	9,052	18,749	8,331	2,083	926
New York, Lake Erie, and Western . . .	13,528	18,665	6,259	1,333	447
Baltimore and Ohio	14,330	18,317	7,856	1,310	561
Central Pacific	6,139	17 371	9,199	2,895	1,533
Chicago, Burlington, and Quincy . . .	12,065	16,190	8,149	1,349	679
Philadelphia and Reading	11,226	16,140	6,972	1,467	634
Chicago and North-Western	8,405	15,797	8,797	1,974	1,100
Union Pacific	3,865	12,857	7,382	3,214	1,845
Chicago, Milwaukee, and St. Paul . . .	10,368	10,930	4,550	1,093	455
Chicago, Rock Island, and Pacific . . .	6,843	10,674	4,878	1,525	697
Wabash, St. Louis, and Pacific	7,800	10,068	3,243	1,258	405
Michigan Central	4,909	8,357	3,049	1,671	610
Atcheson, Topeka, and Santa Fé	5,522	7,357	3,991	1,226	665
Totals and averages . .	152,795	248,654	109,823	1,625 = £320	718 = £144

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The Wages Cost of Railway Labour.

The economy of railway working, like that of other industrial and mercantile undertakings, is necessarily affected by the price at which the labour is purchased, as well as by its comparative efficiency.

As an example of this fact, it is obvious that the cost of the labour employed in India, although apparently much less efficient in reference to results, as tested by mileage open, may yet be much lower than that of the United States, where the nominal relation of *employés* to results is much lower, if we remember that the Indian *employé* is content with a wage of threepence per day, whereas the average wages paid in the United States is 42s. per week, or just twenty-four times that amount per day. Even allowing, then, that each American *employé* performed over four times the same amount of duty as the Hindoo, this would hardly compensate for twenty-four times the average rate of wages.

There is a lack of really trustworthy *data* as to the remuneration paid to the different classes of railway *employés* in the United Kingdom. No doubt the average would, under any circumstances, be difficult to establish, since there is necessarily a wide range between the *maxima* paid in the metropolis and the *minima* paid in Ireland and Wales.

Mr. Macdonnell[1] gave the following as the average wages paid in 1875 to different classes of railway artisans:—

	Wages per Day. s.	d.
Fitters	5	1¾
Turners	5	3¾
Machinemen	3	0
Fitters' labourers	2	4¾
Boilersmiths	5	7
Boilersmiths' labourers	2	11
Smiths	5	2
Smiths' strikers	2	7½

[1] Paper read before the Institution of Civil Engineers, vol. xlviii. p. 15.

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It is not probable that since 1876 the average wages have greatly varied in either direction.

With these rates, we are scarcely in a position to compare exactly parallel rates for other countries. But as regards nearly all the nations on the Continent of Europe, records are made up, and published, showing the average expenditure per *employé* over the whole numbers employed in each of the four departments of general administration, maintenance of way and works, transport or traffic operations, and traction and material. These returns we have collated and summarised in the table that follows, from which it will be seen that there are very considerable differences as between one country and another, not only in the average wages cost per *employé*, but also in the relative numbers employed in each department. The latter fact would almost seem to suggest that there has been a want of parallelism in the returns—that in one country a higher-paid description of labour may be placed under a heading which in another is applied to a lower-priced labour. But, however this may be, the returns, which are in all cases official, are here presented for what they may be worth:—

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Statement showing the Number of Employés *Engaged in each Department of the Railway Administration of European Countries in* 1882, *with the Total Annual Outlay, and the Average Expenditure per* Employé.

Countries.	General Administration.			Maintenance and Surveillance.			Transport, &c.			Traction and Material.		
	Annual Expenditure.			Annual Expenditure.			Annual Expenditure.			Annual Expenditure.		
	Number of *Employés.*	Total Expenditure (£1 = 1000).	Average per *Employé.*	Number of *Employés.*	Total Expenditure (£1 = 1000).	Average per *Employé.*	Number of *Employés.*	Total Expenditure (£1 = 1000).	Average per *Employé.*	Number of *Employés*	Total Expenditure (£1 = 1000).	Average per *Employé.*
Germany . .	12,986	£1,666	£128.3	94,007	£3,274	£34.8	119,155	£5,923	£49.7	75,843	£4,391	£57.9
Austria-Hungary .	3,371	494	146.5	56,221	1,724	30.7	46,225	2,733	59.1	27,018	1,750	64.8
Belgium . .	1,173	107	91.2	15,858	447	28.2	9,567	593	62.0	14,632	699	47.8
Denmark . .	164	15	91.5	2,873	78	27.1	1,854	100	53.9	1,626	65	40.0
France, State lines only . .	3,107	313	100.7	78,330	2,083	26.6	98,917	5,872	59.4	62,638	2,588	41.3
Italy . . .	1,471	129	87.7	12,758	390	30.6	14,481	690	47.6	8,744	481	55.0
Russia . . .	12,222	1,562	127.8	94,772	2,865	30.2	51,838	2,646	51.0	56,641	3,896	68.8
Totals .	34,494	£4,286	...	354,819	£10,861	...	342,037	£18,557	...	247,142	£13,870	...
Averages .	4,928	£612	£124.1	50,688	£1,552	£30.6	48,862	£2,651	£54.3	35,306	£1,981	£56.1

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The figures that are embodied in this table are likely to reward the closest examination on the part of all who are interested in railway economy. They are likely to be especially fruitful of advantageous results if considered in relation to the traffic movement of the countries tabulated,[1] their gross and net earnings,[2] the mileage open,[3] and other statistical *data* to be found scattered throughout the present work. There may, however, be certain facts that will be difficult of reconciliation. One of these, lying on the surface, is the remarkable discrepancy in the relative numbers employed in maintenance and transport, respectively, in Germany and Russia. But similar cases might be indefinitely multiplied.

The *data* already given may be supplemented by the following more specific details of the wages paid in Belgium, Germany, Switzerland, and France, to the principal classes of railway *employés*, as taken from the Report of the Royal Commission on Railway Accidents :—

Statement showing the Average Monthly Wages Paid to Railway Employés *in Continental Countries.*

Description.	Average Wages Paid in			
	Belgium, per Month.	Germany, per Month.	Switzerland, per Month.	France, per Month.
Drivers[4] .	£5, 4s. to £6, 8s.	£6, 5s.	£7 to £8	£8
Guards .	£3, 15s. to £4, 6s.	£3, 15s.	£4 to £4, 5s.	£2 to £4
Shunters .	£2, 18s. to £3, 6s.	£2, 15s. to £3, 10s.	£2, 5s. to £3	2/6 per day
Sorters .	£2, 18s. to £3, 6s.	Do.	£2, 5s. to £3, 5s.	Do.
Signalmen	£3, 0s. to £3, 15s.	£2, 10s. to £3, 0s.	...	£3, 10s. to £4
Plate-layers	£2, 5s. to £3, 10s.	1/6 to 2/6 daily.	2/6 per day	2/6 per day

[1] *Vide* chap. xv. [2] *Vide* chap. vii. [3] *Vide* chap. i.

[4] In Belgium, Switzerland, and France, the drivers receive premiums for economy of fuel and oil, which vary from an average of about £10 in Belgium to £40, and even more, in France.

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The foregoing figures would not, however, be complete, unless they were illustrated and supplemented by records of the hours of labour in each country, which, on the same authority,[1] are stated to be as under:—

Description of *Employé.*	Average Hours of Labour per Day in			
	Belgium.	Germany.	Switzerland.	France.
Drivers . .	12	9 to 10	12 to 14	8
Shunters .	8 to 14	9 „ 12	14 „ 15	12
Guards . .	11 „ 15	9 „ 10	12 „ 14	...
Signalmen .	8 „ 14	12 „ 14	...	8 to 12[2]
Plate-layers .	12	9 „ 12	12	12
Sorters . .	8 to 12[3]	9 „ 12	14 to 15	12

The last country to which we shall direct attention, in reference to the subject of labour cost, is the United States. The Census Reports for 1880 furnish *data* which allow of the average rates of wages per month being estimated for each of the fifteen leading railways in that country. It will be noted that the highest average wages were paid on the Central Pacific and the Atcheson, Topeka, and Santa Fé line, and the lowest on the Chicago, Burlington, and Quincy, and the Baltimore and Ohio. It is not a little remarkable that the average wages paid on one of these lines was more than double that paid on another. The details are as follow:—

[1] Report of Royal Commission on Railway Accidents, p. 187.

[2] 8 hours at junctions; 12 hours at stations.

[3] Where a double *personnel* is employed, sorters, shunters, and signalmen are never employed for more than 12 hours.

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Statement showing the Numbers of Employés *on the Fifteen Leading Railways of the United States during the Census Year* 1880, *excluding General Officers and Clerks, and the Average Wages Paid per Month in each case.*

Railways.	Number of *Employés.*	Average Wages Paid per Month.
		Dols.
Pennsylvania	25,736	41.72
New York Central	13,007	41.95
Lake Shore and Michigan . .	9,052	48.12
New York, Lake Erie, and Western	13,528	43.94
Baltimore and Ohio	14,330	34.76
Central Pacific	6,139	63,21
Chicago, Burlington, and Quincy .	12,065	31.77
Philadelphia and Reading . .	11,226	38.73
Chicago and North-Western . .	8,405	45.16
Union Pacific	3,865	57.64
Chicago, Milwaukee, and St. Paul .	10,368	34.93
Chicago, Rock Island, and Pacific .	6,843	38.80
Wabash, St. Louis, and Pacific .	7,800	43.91
Michigan Central	4,909	42.43
Atcheson, Topeka, and Santa Fé .	5,522	53.67
Total and average . .	152,795	41.15

On comparing these returns with those that we have already given for the principal European countries, the absolutely higher rate of wages paid in the United States becomes at once apparent, the number of *employés*—excluding those engaged in general administration, as in the returns for the United States—the total annual amount paid as wages, and the average annual wages paid per *employé* in the four chief Continental countries being as under:—

Countries.	Number of Railway *Employés.*	Total Amount Paid as Wages.	Average per *Employé* per Annum.
Germany . . .	289,005	£13,600,000	£47
France	239,885	10,542,000	44
Austria-Hungary . .	129,464	6,207,000	48
Russia	203,251	9,407,200	46

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The average wages paid to the same classes of labour in the United States being about £99 per annum, it follows that American railway labour costs more than double that of Continental Europe.

This is a fact of great significance in relation to the subject of the costs of working, and the goods tariffs imposed, as dealt with in other chapters of this work.

The natural inference would seem to be, that as a result of requiring to pay so much more for labour, American railways would also require to impose much higher rates for transport. This, however, is very far from being the case. The average rate charged in 1880 for the transport of merchandise of all descriptions carried on the railways of the United States was only .64d. per ton per mile. This figure is believed to be about one-half of the average rate charged on the railways of the United Kingdom. And yet, as we have elsewhere shown, the railways of the United States are able, in general, to pay as good dividends as those of the United Kingdom, even with a much smaller average volume of traffic per mile of line open. With such facts as these staring them in the face, English railway directors can scarcely fail to admit that, so far as economy of working is concerned—disregarding for the present the almost equally important question of efficiency of service—the railways of the United States are in the front rank.

In the next table the relation of the *personnel* to the mileage of line open in different European countries is set forth :—

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Statement showing the Number of Employés *on the Railways of Continental Europe, distinguishing those in receipt of Salaries and Daily Pay, with the Average of each, and the Cost of the* Personnel *per Kilometre Open.*

Countries.	Total Number of *Employés.*		*Personnel* per Kilometre Open.		Annual Expenditure on *Personnel.*	
	Salaried.	Daily Wage-Earners.	Salaried.	Daily Wage-Earners.	Total (1 fr. = 1000).	Average per Kilometre Exploited.
Germany	131,093	172,898	3.74	4.93	381,382	10,890
Austria-Hungary	54,753	98,082	2.89	4.13	167,535 On State Lines only.	8,860
Belgium	8,257	37,804	2.25	10.29	46,129	15,504
Denmark	2,112	4,405	1.34	2.78	6,431	4,050
France	158,948	84,044	5.69	3.01	271,385	9,724
Italy	46,836	24,857	5.20	2.76	72,383	8,050
Luxembourg	118	610	0.80	4.10	...	...
Holland	4,472	9,634	2.29	4.93	...	...
Roumania	2,646	4,281	2.01	3.26	...	...
Russia	154,454	61,019	6.71	2.65	274,223	11,975
Switzerland	9,380	5,946	3.42	2.17	...	...
Totals and averages	573,069	503,580	3.30	4.09	...	...

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This table so far speaks for itself as to require but little comment. It will be noted that *salaried* officials preponderate in France, Italy, Switzerland, and Russia; that *daily wage-earners* are a majority in Germany, Austria, Belgium, Denmark, Holland, and Roumania; and that the expenditure on *personnel*, relatively to the extent of railway opened for traffic, is highest in Germany, Belgium, and Russia, while it is least in Denmark, Austria, Italy, and France.

It is not necessary to pursue this subject further. The great array of figures that has, with infinite trouble, and the utmost care to ensure accuracy of details, been brought together, has sufficiently indicated the differences that distinguish the principal countries of the world in reference to their railway *personnel*. We have also shown the vast importance of the subject, alike as regards the numbers dealt with and the great amounts expended in their maintenance. We are fully conscious that much more might have been made of this matter, which, indeed, is itself so replete with interest and economic value as to be worthy of a special treatise; but it now needs that, so far as the present work is concerned, we should proceed to consider other railway problems that equally press for solution.

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CHAPTER XIV.

ROLLING STOCK.

AMONG the factors that determine the ultimate economy of working goods traffic, there are three that stand out with special prominence, namely—

1. The rate of speed.
2. The adoption of full train-loads.
3. The due relation of goods wagons to the extent of traffic.

The two last-named considerations are sufficiently important to demand careful analysis at the hands of all who would make themselves familiar with the problems which they present, and the conditions of their solution.

Unfortunately, however, the *data* necessary to an entire appreciation of the questions set forth are not at command. We have not, in England, any details of the extent to which the wagons belonging to the several railway companies are utilised. We cannot tell whether the average train-load is made up of wagons that are half full, or three-quarters full, or whether the usual wagon-load is only one-quarter of the capacity.

On a number of leading railways, there was for a long period, and still exists, a rule-of-thumb method of determining the capital expenditure required for rolling stock, viz., that such expenditure should be approximately equal to the gross annual amount of the traffic. On many English lines the relation of rolling stock is higher, and

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on others it is lower, than this ratio. The following statement shows the gross annual receipts of *English railways*, the total numbers of the rolling stock of all kinds employed by the railways, as such, and the percentage of the rolling stock on the total gross receipts for the period 1874–84.

Years.	Gross Annual Receipts from all Traffic (1=1000.)	Number of Vehicles of all Kinds.	Percentage of Rolling Stock on Gross Receipts.
1874	£48,142	304,983	0.63
1875	49,771	317,667	0.64
1876	50,504	324,016	0.64
1877	51,063	324,454	0.64
1878	51,069	327,104	0.64
1879	50,437	329,213	0.65
1880	53,598	337,751	0.63
1881	54,924	347,662	0.63
1882	56,596	363,290	0.64
1883	57,978	389,782	0.67
1884	57,557	411,188	0.71

It would be interesting to carry this comparison further, if we had at command the full materials necessary to that end; but in the absence of specific details of the proportions of railway companies' and private owners' wagons on the different lines, any attempt to compare one railway with another would only be apt to mislead. On some railways the wagons are almost exclusively the property of the railway companies; on others, the wagons owned by private firms are probably as numerous as those belonging to the railways, as such.

While the figures just quoted show that the percentage proportion of rolling stock on the gross receipts has increased within recent years, this may not necessarily mean that the proportionate expenditure on rolling stock has also been augmented. The cost of constructing rolling stock of all kinds has been materially reduced, as

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between 1874 and 1884, and it is quite on the cards that the amount invested in rolling stock, relatively to the gross receipts, has not been sensibly raised. What that amount is, in the case of English railways, it is impossible to calculate. If we were to assume the relation of such cost to the gross annual income from traffic to be as above stated, the average would be found for 1884 to amount to about £116 per vehicle; but this is merely an empirical figure, and must not be received as of any real value.

Utilisation of Wagon Capacity.

In almost all European countries, except England, returns are kept of the total capacity of the wagons belonging to the different railway systems, and of the proportion of such capacity utilised in the working of goods traffic.

These *data* are important as enabling an estimate to be formed of the comparative economy that distinguishes the working of such traffic in each country.

The following is an abstract of such returns, as applicable to the four principal countries that compete with Great Britain, distinguishing State from private lines. It will be observed that Germany appears to show the best results, with ninety-nine tons carried per ton of wagon capacity on the private companies' lines worked by the State, and eighty-eight tons carried per ton of capacity on the companies' lines under private control. The worst results appear on the State lines of France and on the State lines of Belgium.

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Statement showing the Total Tonnage Capacity of the Wagons Owned by the Principal Railways on the Continent of Europe, with the Total Tonnage of Merchandise of all Kinds Carried by each, the Average Tonnage Capacity per Wagon, and the Tonnage Carried per Ton of Total Wagon Capacity.

Railways.	Total Capacity of Wagons, Tons.	Total Tonnage of Merchandise Carried (1 = 1000).	Tonnage Carried per Ton of Wagon Capacity.	Average Tonnage Capacity per Wagon.
Germany—				
State lines . . .	1,803,391	140,613	78	9.57
Private lines worked by the State .	194,987	19,348	99	10.05
Companies' lines . .	269,257	23,846	88	9.62
Austria—				
State lines . . .	88,202	6,335	72	9.81
State lines worked by companies .	9,387	712	76	9.85
Private lines worked by the State .	74,423	5,568	75	9.60
Companies' lines . .	696,649	52,139	75	10.23
Belgium—				
State lines . . .	432,276	21,968	51	10.02
Companies' lines . .	72,477	5,672	78	10.06
France—				
General State lines .	85,640	3,008	35	8.41
General companies' lines	1,972,376	88,322	45	8.99

This condition of things seems to be all the more remarkable when we remember that on the Belgian lines the average length of lead is only 66 kilometres, as compared with 81 kilometres in Germany.

It is undoubtedly necessary to get behind the facts in order to appreciate this anomaly. The truth is, that in Belgium there are many more private owners' wagons than in any other European country, and as these private wagons do not appear in the returns, they disturb, and practically vitiate, the comparison.

Contrary to what might have been expected, there is

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no European country that utilises its wagon capacity to the same extent as Russia. The percentage of such capacity utilised in 1882 on the Russian railways was 49.50 per cent., as compared with 45 per cent. on the German, 38 per cent. on the Belgian and Italian, and 27 per cent. on the Danish lines. The statistics of the average length of lead, and the average percentage of wagon capacity utilised for each Continental country are shown in the following table, alongside of similar returns for passenger traffic, for purposes of comparison :—

Statement showing the Average Distance over which Passengers and Goods Traffic were severally Transported in Different European Countries in 1882, with the Percentage of Available Passenger Places Occupied, and the Percentage of Wagon Capacity Utilised.

Countries.	Average Distance Travelled per Passenger.	Percentage of Available Places Occupied.	Average Length of Lead for Goods Traffic.	Percentage of Wagon Capacity Utilised.
	kilometres.	per cent.	kilometres.	per cent.
Germany	30.02	23.66	81.74	45.04
Austria	46.77	24.27	81.10	45.11
Belgium	20.92	20.79	66.01	38.20
Denmark . . .	29.40	25.76	64.18	27.09
France	33.54	...	112.95	...
Italy	48.32	25.73	120.25	38.75
Norway	29.15	24.10	57.32	35.19
Holland	28.25	20.80	78.09	33.89
Roumania . . .	75.13	32.22	119.86	37.12
Russia	106.45	33.90	213.42	49.50
Finland	37.48	25.25	107.13	41.69
Switzerland . . .	22.01	30.93	54.23	31.23
Averages . .	42.29	26.13	96.36	38.44

There is not a little reason to believe that the tare of the goods wagons used on the majority of English lines is much greater, by comparison with the live or paying load, than in the United States and some European countries,

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which is sufficient, of itself, to account for the less remunerative character of the traffic, relatively to the tonnage carried and the rates charged. Mr. E. B. Dorsey sets this out in his paper on "English and American Railroads," when he states that "the average English freight car, or, as it is called in England, goods wagon, carries a load of 8 tons, and weighs 5 tons, being 1.6 to 1, while with the American box freight car, carrying 50,000 lbs. (22½ tons), and weighing 23,000 lbs. (10 tons), the proportion is 2.13 to 1.[1] This represents, in favour of the American system, an enormous economy of tare, and a consequent saving of the cost of working the goods traffic. The Continental practice is much akin to that of England. Few wagons on the Continent have a greater capacity than 10 tons, and in a number of countries they are under that figure. There is no exact mathematical formula of universal application, which fixes the relation of tare to carrying capacity, but, in a general way, the tare will be found to be relatively less as the size of the wagon is increased, and hence it may be presumed that Continental traffic, like the English, is less economically worked than that of the United States.[2]

The following tabular statement, which we have compiled from the railway returns of the several European countries, shows the number of wagons owned by the railways, as such, on the Continent, both absolutely and relatively to the mileage open and the tonnage of goods traffic carried:—

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[1] *Transactions of the American Society of Civil Engineers*, vol. xv. p. 11.

[2] This question is more fully considered in the chapters that deal with the special characteristics of American and English railway working.

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Statement showing the Number, the Total and Average Capacity of Goods or Merchandise Wagons, and the Capacity of the Wagons Employed, per Kilometre of Line Exploited, in the Principal Countries of Europe.

Countries.	Number of Wagons.	Total Capacity of Wagons in Metrical Tons.	Average Capacity per Wagon in Metrical Tons.	Wagon Capacity per Kilometre Exploited.	Total Tons Carried (1=1000).	Average Annual Tonnage Carried per Wagon.
Germany	235,708	2,267,635	9.62	64.58	183,808	778
Austria	85,785	868,661	10.12	45.25	64,754	755
Belgium	50,164	504,753	10.06	153.03	27,640	559
Denmark	2,913	23,124	7.94	14.52	1,148	393
France	222,232	1,994,982	8.97	69.77	96,821	436
Italy	28,643	254,099	8.90	28.20	11,598	405
Luxembourg	812	8,918	10.98	59.85	1,925	2,370
Norway	2,550	18,578	7.28	13.84	674	265
Netherlands	7,584	74,279	9.84	37.32	5,939	783
Roumania	4,943	48,802	9.86	35.13	1,397	282
Russia	115,699	1,117,541	9.66	48.98	44,067	380
Finland	2,177	15,897	7.30	19.10	646	297
Switzerland	8,720	89,666	10.28	31.19	6,366	730
Totals and averages	767,933	7,286,935	9.5	...	446,983	582
United Kingdom	454,945	3,637,560	8.0	...	219,974	483
United States	748,661	14,973,220	20.0	...	400,453	535

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The remarkable differences found in these figures are more than sufficient to confirm the statement already made as to the great caution with which any returns of the relation of railway companies' wagons to the tonnage of goods carried should be received and considered. These figures would seem to show that France has nearly twice the number of wagons, relatively to the tonnage carried, that is owned by the German lines; that in Luxembourg about three times the tonnage is carried annually per wagon that Germany or Austria can show; that in the United Kingdom, where the average length of lead is perhaps shorter than that of any country in the world, the average annual tonnage carried per wagon is about 100 tons less than that of Continental Europe; and that in the United States, notwithstanding the fact already stated as to the very much greater capacity of the wagons, the average annual tonnage carried per wagon is less than on the Continent of Europe. All these appearances, it need hardly be remarked, are more or less deceptive. Before any one of the figures could be entirely depended on, it would be necessary to know exactly the proportions of companies' and traders' wagons relatively to the tonnage carried in each country. And even then, the desired result could not be attained without taking account of the character of the traffic carried, and the average length of lead in each country, since it is manifest that a wagon may be more profitably employed in carrying a hundred tons of goods charged at a high rate than in moving twice that tonnage of minerals charged at a low rate, while a wagon that moved 1000 tons a distance of ten miles would not have rendered the same amount of service as another that carried 500 tons for thirty miles.

As already indicated, Russia is distinguished by having at once the greatest length of lead among Continental countries, and the greatest utilisation of wagon capacity. Austria and Germany do not come far behind, while Belgium and

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Italy are very much on all fours. It is, however, to be remarked that in the countries that have a large mineral traffic, which is generally carried in full train-loads, it might fairly be assumed that the percentage of wagon capacity utilised would be higher than in countries where such traffic is of more limited dimensions. Such does not appear to be really the fact. Belgium has perhaps the largest mineral traffic for its area of any country on the Continent, and yet, in respect of the test of railway economy under consideration, it comes some distance behind Austria, where the mineral traffic is relatively much smaller, and Russia, where it is very trifling indeed. It may be remarked, by the way, that the poorer countries appear to take the greatest pains to secure full train-loads of passengers, the highest percentage of available places occupied occurring in Denmark, Italy, Russia, Roumania, Finland, and Switzerland.

If we proceed to examine the relative circumstances of the principal English lines in reference to the subject of wagon supply, we can hardly fail to be struck by the variations that are found to appear. These may be traced in the following tabular statement:—

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Statement showing the Number of Wagons Owned by the Principal Railways in the United Kingdom, with the Tons of Merchandise Carried, the Total Receipts from Goods Traffic, and the Estimated Tonnage Carried and Gross Receipts Earned per Wagon.

Railways.	Number of Wagons of all Kinds.	Tons of Merchandise Carried (1=1000).	Total Receipts from Goods Traffic (£1=1000).	Tons Carried per Wagon.	Gross Receipts Earned per Wagon.
Lancashire and Yorkshire	20,278	15,386	£2,271	759	£112
London and North-Western	48,849	33,911	6,106	694	125
London and South-Western	7,234	13,567	883	493	122
London, Brighton, and South Coast	7,081	2,452	537	346	76
London, Chatham, and Dover	1,967	2,150	249	1,093	127
Manchester, Sheffield, and Lincoln	12,529	10,889	1,308	869	104
Midland	75,098	24,466	5,020	326	67
North-Eastern	76,076	36,993	4,419	486	58
Taff Vale	2,131	9,672	582	4,539	273
Caledonian	43,343	14,670	1,849	338	43
Glasgow and South-Western	11,389	4,839	619	425	54
North British	32,471	13,298	1,599	410	49
Great Eastern	13,179	6,963	1,562	528	119
Great Northern	19,747	9,578	2,064	485	105
Great Western	36,024	23,827	4,229	661	117

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With reference to the differences that appear in the annual tonnage carried per wagon, and the gross annual earnings therefrom, it is to be observed that the Midland and the Caledonian are perhaps the only two English lines which have adopted the policy of buying up all the private wagons on their system, and it will be observed that both of these lines appear to correspond very closely in the annual tonnage carried per wagon owned. There is, however, a great difference in the gross earnings per wagon as between these two companies, the Midland being £24 per wagon, or 55 per cent, higher than the Caledonian. This fact is quite in accordance with what is known as to the conditions of the traffic on the two systems, the Caledonian having generally a much shorter length of lead, and receiving for a great portion of its mineral traffic perhaps the lowest short distance rates in the world. There are other figures in this Table that require a good deal of explanation. In the case of the London, Chatham, and Dover line, for example, it appears as if each wagon carried 1093 tons during the year; but the fact is, that probably two-thirds of the goods traffic carried on this system, and especially the mineral traffic, is carried in private traders' wagons; while, as regards the Taff Vale Company, it is obvious that the traffic is chiefly carried in wagons that are not owned by the company.

These and cognate considerations suggest whether the Board of Trade is not to some extent conveying a wrong impression when they publish, as they annually do, not only the total number of wagons owned by each company, but the average number per mile, without any explanatory or qualifying notes. According to these official returns, it would appear as if the average number of wagons used per mile of line open had increased from 20.60 in 1874 to 24.12 in 1884. An increase in the number of wagons per mile open is only what might be expected to follow from the great increase of traffic; but since the increase of tonnage carried, as between 1874 and 1884, was not

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less than 72 millions of tons, or about 40 per cent., it is probable that the increase of wagons was greater than the ratio indicated by the Board of Trade returns; and, in any case, it is certain that the real number of wagons employed, and necessary for the actual requirements of the traffic, is not 24.12, as shown in the Board of Trade returns, but nearly, if not quite, double that per mile of line open.

In the principal European countries, besides Great Britain, the wagons employed *by the railway companies* per mile line of open were, in 1882, as under:—

Countries.	Number of Wagons.	Miles Open.	Average Wagons per Mile.
Germany . . .	235,708	21,785	10
Austria	172,996	12,603	13
France	222,232	16,578	14
Belgium	50,164	1,885	26
Italy	57,495	5,871	10

In the United States the railway companies owned, in 1883, 748,661 freight cars of all sorts, giving an average of 6.2 per mile of line. On the railways of British India, where the companies mainly find the rolling stock, the total number of wagons in 1882 was 44,255 for 10,144 miles of railway, being an average of nearly 4.4 wagons per mile.

There are no means of arriving at a correct estimation of the total number of traders' wagons that are run on the several railways of the United Kingdom, and hence there is no method whereby we can judge of the extent to which economy is practised in the relation of this description of rolling stock to the traffic carried. On some lines the wagons of private traders are more numerous than the wagons belonging to the railway company; on others, the wagons are nearly, if not altogether, the property of the railway. The enormous disproportion of the traffic

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carried to the companies' wagons is exhibited in the table that follows, showing as it does that the Caledonian Railway, with a total traffic of less than 15 million tons, has within 6000 of the same number of wagons as the London and North-Western Railway, with a traffic of about 34 millions; and that the Midland Company, with a traffic of 24½ million tons, has 26,000 more wagons than the London and North-Western, with its total traffic of 34 millions. The effect of this state of affairs is, that if we were to divide the total number of wagons owned by each separate company into the total tons of traffic carried we should find the most remarkable differences. It would appear, for example, as if the wagons of the London and North-Western line carried an average of 694 tons per annum, while those of the Caledonian carried no more than 338; and so with the other lines. The real truth is, that there will probably be almost as many traders' wagons as there are wagons belonging to railway companies. This view is supported by strong presumptive, and by a considerable amount of direct evidence. The Caledonian Company, for example, arranged some years ago to buy up all the private traders' wagons on their system, so that now the whole of their traffic is practically carried in their own rolling stock. This, therefore, is a good case to adopt as a basis; and by so using it we find that each wagon belonging to the Caledonian Company carried in 1884 an average of 338 tons of goods traffic of all descriptions. If we take this average, and apply it to the 259½ tons of mineral and goods traffic carried on the railways of the United Kingdom in 1884, we shall find that it would require the employment of over 750,000 wagons, instead of the 454,945 wagons returned as owned by the railways, leaving a remainder of 301,000 wagons to be furnished by traders. It is obvious that this is a very rough and ready method of estimation. Averages do not settle everything; and in the present case there are several other important elements to be taken into account, such as the general

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length of lead, and the description of traffic carried. With reference to both of these points, the Caledonian Company occupies a somewhat exceptional position. The great bulk of its traffic is carried over very short distances, and about 80 per cent. of the whole volume of its goods traffic takes the form of minerals, which are generally carried in full truck-loads, and not, as in the case of other goods traffic, in smaller volume. If, therefore, the average annual tonnage carried per wagon on the Caledonian system is only 338 tons, we are justified in assuming that the average of the country as a whole, taking into account the much longer average length of lead and the more varied character of the traffic, will be considerably under that figure; and if we put it at 250 tons, we are not likely to be above the mark. This figure, then, would lead us to the conclusion that there are not less than 1,037,000 wagons employed in carrying on the railway traffic of this country, being 582,000, or about 120 per cent., more than the total number owned by the railway companies.

This circumstance supplies food for serious reflection. It must either be that the Midland, the Caledonian, and other companies that have purchased practically the whole of the wagons run on their system have pursued a right policy, or that the course persisted in by the London and North-Western, the Taff Vale, and other lines, of allowing the traffic to be carried very largely in the wagons of private traders, is the right one. Which is it? There are no figures to show what is the real economic difference between the two systems. But if, as it is reasonable to suppose, a railway company gains considerably by getting the whole of the wagons into its own hands, that arrangement is likely to ultimately be the best for traders also. Every railway manager and engineer is aware of the great cost that is involved in sorting wagons, when there are hundreds of different owners to deal with. By having the wagons wholly in the possession of the railway company, this cost is to a large extent obviated. On the other

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hand, however, the private trader is often disposed to think that the possession of the rolling stock required for his own particular traffic gives him a greater control over the working of that traffic, and ensures in a higher degree the essential qualities of quicker transport and punctuality. There is something to be said on both sides, and if the problem had been easily disposed of, it would probably have been settled long ago.

The complication that arises from traders' and companies' wagons being so mixed up as to render any intelligible analysis of the results of working goods traffic—so far, at least, as the relation of rolling stock to traffic carried may be taken as a basis—orginated in, and has been perpetuated by, the fiction which regards railway companies as toll-takers only.

Parliament has not provided that the companies are bound to carry the traffic themselves. On the contrary, it has enacted that when a railway is open any persons may use it with their engines and carriages upon certain conditions, and that the railway companies are themselves at liberty to carry the traffic in their own vehicles; but if they carry it, they may levy tolls not exceeding the amount laid down in their special Acts.

The companies, in fact, may elect either to carry the traffic and to provide the whole of the engines and carriages and wagons, or to allow traders to provide the wagons themselves, the company merely providing the locomotive power; or they may leave the traders to provide both; but they are not bound to provide accommodation for the wagons or engines at the stations, or otherwise, except for the mere transit along the lines.

Under their general Acts, ample powers are given to the railway companies to control the description and quality of wagons used by traders, and the regulations under which they may be run, so as to ensure freedom from accident; but there is no provision for ensuring that the movements of traders' wagons, when used, shall be

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regulated, and delays prevented, with the same degree of care as is practised with the companies' wagons.

The Royal Commission of 1867 recommended that "railway companies should avail themselves of every opportunity of obtaining possession of the railway plant used on their lines." They added, that "it appears deserving of consideration whether the system of charging a mileage rate for wagons should not be modified, and a system of charging for the wagon by time, instead of by distance, be adopted in Acts of Parliament."

There are several arguments of great cogency used both for and against the acquisition by the railways of the whole of the wagons that use their lines. These have been so admirably summarised in the Report of the Commission of 1867 that we present them here in their entirety:—

"On some of the older railways the owners of collieries continue to run over the lines with their own engines and carriages for short distances. This is, however, a very exceptional arrangement; but it is a common case on many lines for traders to provide their own wagons, the railway companies finding the engine power and treating them as their own wagons, and in such cases a deduction from the rate of about ⅛d. per ton per mile is made.

"The conditions under which wagons belonging to traders are allowed to be used on railways has been a matter of complaint. It is alleged that great detention of these wagons occurs on railways; and that whilst railway companies enforce with great strictness claims for demurrage when their own wagons are detained by traders, they allow no compensation to traders when long detentions have occurred of traders' wagons.

"The railway companies, on the other hand, urge that traders frequently use these wagons as warehouses in which to store, upon the railway sidings, the articles they are sending, and that the delays occur more frequently upon the consignee's premises than upon the railway.

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"The traders also allege that their wagons are very little cared for, and often return in a very neglected condition; but the railway companies allege that the wagons are often of inferior quality, and ill adapted to the service they have to perform. Difficulties are also alleged to occur in the case of a break-down, or when repairs are wanted. The traders complain that the railway companies in such cases put the wagons into a siding and leave them there without giving the traders notice of the injury; and the railway companies allege that the traders make difficulties about paying for repairs.

"It is quite clear that the use of private wagons, each of which must be returned empty to its owner, causes much extra trouble and expense in arranging the trains and returning the empty wagons, and that if all the wagons belonged to the railway a considerable diminution in the number of wagons now necessarily in use on the railways could be effected; indeed it is alleged that one-third of the whole number might be saved; but, on the other hand, individual traders might suffer from not being able to obtain all the wagons they might require to meet sudden emergencies, or a general briskness of trade.

"It is shown that the profit obtained from a wagon fully loaded is very considerable. It is obvious, however, that the system of charging for wagons a rate per mile run by no means meets the justice of the case, as the cost of a wagon is estimated by time and not by distance. Thus companies have been formed for the purpose of letting out wagons and carriages at a yearly rate, and the railway companies make a daily charge for the demurrage to be paid on wagons detained off their lines.

"It is obvious that a mileage rate is for long distances as much too high as for short distances it is much too low, the time for loading and unloading a wagon bearing no proportion to the distance run."

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CHAPTER XV.

TRAFFIC CHARGES.

ONE of the principal items of the cost incurred in working all railways alike is that which is generally spoken of as "traffic charges"—that is to say, the actual cost of carrying on the operations of railways, in their original and still principal function of common carriers. This item does not include any part of the expenses of laying down and maintaining the permanent way, nor of providing and keeping up locomotive power; but is concerned only with the outlay incidental to handling the traffic, as such. It is, as might be expected, the most considerable item of any in the list of railway expenditure, and in the United Kingdom it usually represents about 30 per cent. of the total working cost.[1] It does not, however, amount to the same proportion of the whole in all countries. In Luxembourg it is only 14.20 of the whole, whereas in the neighbouring country of Germany it rises to 37.20 per cent., and in Holland, which is also close by, it is 36.18 per cent. Equally remarkable differences are to be found in the varying proportions which traffic charges bear to the total working expenditure on the railways of the United Kingdom. On the Great Western, for example, they only amount to 8.62d. per train mile, whereas on the London and North-Western they are as much as 12.21d. per train mile. On the Midland they are 9.38d. per train mile, and

[1] In the year 1884 it was exactly 31 per cent. of the whole.

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on the neighbouring Manchester, Sheffield, and Lincoln Railway they rise to 11.88d. per train mile. These variations necessarily admit of explanations, more or less complete; and considering the vast importance of the subject as a whole, it is desirable that it should be looked into rather closely.

In order that the relation which traffic charges bear to the other principal items of railway expenditure may be appreciated, the following table has been compiled, showing, as regards thirteen Continental countries, the working expenditure of their several railway systems, under the four principal headings of general administration, maintenance of way, traffic charges, and traction and material, or locomotive power:—

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Statement showing the Working Expenses of Railways in Different European Countries in 1882.

Countries.	General Administration.		Maintenance of Way, &c.		Traffic Charges.		Locomotive Power, &c.	
	Per Kilometre.	Per Cent. of Total Expenses.	Per Kilometre.	Per Cent. of Total Expenses.	Per Kilometre.	Per Cent. of Total Expenses.	Per Kilometre.	Per Cent. of Total Expenses.
	francs.		francs.		francs.		francs.	
Germany	1,712	9.90	4,617	26.60	6,452	37.20	4,560	26.30
Austria-Hungary . .	1,124	7.37	4,728	31.02	4,880	32.01	3,979	26.08
Belgium	1,280	5.61	5,499	24.13	6,089	26.72	9,928	43.54
Denmark	497	6.39	2,586	33.21	2,200	28.21	2,496	32.19
France	2,052	9.85	4,387	21.08	7,141	34.33	7,225	34.74
Italy	1,296	8.76	3,934	26.68	4,704	31.84	4,838	32.72
Luxembourg . . .	2,227	20.70	2,860	26.50	1,527	14.20	4,157	38.60
Norway	306	7.00	1,680	38.58	1,110	25.50	1,257	28.92
Holland	1,153	7.94	4,009	27.60	5,258	36.18	4,112	28.28
Roumania	625	5.69	3,997	36.33	2,620	23.80	3,759	34.18
Russia	3,484	13.85	7,845	31.17	5,324	21.16	8,512	33.82
Finland	557	9.78	2,245	39.40	1,529	26.81	1,369	24.01
Switzerland . . .	1,011	8.57	3,265	27.64	3,522	29.83	4,010	33.93
Averages . .	1,333	9.34	3,973	29.99	4,027	28.29	4,631	32.10

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A distinguishing feature of this statement is, that as regards most Continental countries, the locomotive power amounts to a larger sum than the traffic expenses. This is not the case on English railways. On the latter, as a whole, the average expenditure for locomotive power in 1884 was only 8.35d. per train mile, as compared with 9.91d. per train mile for traffic charges. In 1873, however, it was otherwise. Locomotive power then cost our railways as a whole 11.09d. per train mile, or 2.74d. more than in 1884; whereas traffic charges amounted to 10.25d. per train mile, as compared with 9.91d. in 1884, being a reduction of .34d. per train mile. In other words, locomotive power has in the interval been reduced by 25 per cent., while traffic charges have only fallen to the extent of about 3 per cent.[1]

The following table shows how the traffic charges per train mile have varied on the principal railways in the United Kingdom as between 1874 and 1884:—

Comparison of Traffic Charges per Train Mile in 1874 and 1884 on British Railways.

Railways.	Traffic Charges per Train Mile in		Increase or Decrease of Amount in 1884.	Percentage of Increase or Decrease in 1884.
	1874.	1884.		
	d.	d.	d.	per cent.
Caledonian	9.28	8.50	− 0.78	8
Great Eastern	11.64	10.19	− 1.45	12
Great Northern	10.94	9.57	− 1.37	13
Great Western	9.79	8.62	− 1.17	12
Great Western of Ireland	8.23	9.47	+ 1.24	15
Lancashire and Yorkshire	16.66	13.21	− 3.45	21
London and North-Western	11.77	12.21	+ 0.44	4
London and South-Western	12.24	11.23	− 1.01	8
London, Brighton, and South Coast	9.30	8.99	− 0.31	3
Manchester, Sheffield, and Lincoln	11.78	11.88	+ 0.10	1
Midland	11.55	9.38	− 2.17	19
North-Eastern	9.30	9.17	− 0.13	1
South-Eastern	12.72	9.80	− 2.92	23

[1] It is to be remarked, however, that, in 1873, locomotive charges were exceptionally high, owing to the high cost of materials and fuel.

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It appears to be clearly proved by these figures that railway companies do not uniformly follow the same methods of procedure, and are not uniformly affected by the conditions of the labour market and the prices of commodities; otherwise it would be difficult to understand how one line (the Lancashire and Yorkshire) could diminish its expenditure by 21 per cent., while another line (the Great Western of Ireland) advanced its expenditure by 15 per cent., in respect of precisely the same item. The truth is, that there is no branch of railway expenditure that offers so much scope for economy or extravagance, according as the directorate of a railway is disposed to look into the spending department closely, or allow a lax and largely unchecked control of minor outgoings to prevail.

This is the veriest truism to all railway men; but its range of application may be fitly illustrated by the example of one of our principal and most typical lines—the London and North-Western. On this railway the traffic expenses, in respect of the coaching and police, and the merchandise departments, respectively, were as under for the ten years ending December 31, 1885:—

Items.	Coaching Department.	Merchandise Department.
Wages	£4,294,876	£7,948,449
Fuel, &c.	1,128,500	517,880
Clothing	216,358	13,800
Printing, &c. . . .	299,621	181,757
Horses, vans, &c. . .	....	1,828,434
Wagon-covers, &c. . .	...	264,014
Joint station expenses . .	380,528	174,202
Agents' commission . .	...	57,185
Hoists, cranes, &c. . .	...	484,661
Miscellaneous . . .	239,474	...
Totals . . .	£6,559,358	£11,470,380

Now, it will be observed, as regards the most of these

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items, that they represent elements of a more or less elastic character. This will be fully demonstrated if we look into the various items in their relation to the train mileage run, or to any other good standard of comparison and analysis, for different dates extending over the decennial period to which our figures relate. It will be found, in fact, that the expenditure per train mile is not the same in respect of any one item for any two dates.

One item that is calculated to excite surprise is that of fuel. The expenditure incurred on this account does not, of course, refer to locomotive fuel, which is provided for under the head of locomotive charges. The general tendency, however, in respect of all items, has been towards reduction within recent years. This tendency appears more especially in printing, horses and vans, wagon-covers, &c., and agents' commission, all of which are lower in amount for 1885 than for 1876, notwithstanding that in the interval the train mileage has increased by about six millions of miles, and all the other *criteria* point to an extended business. Wages form a remarkable exception to the contrary.

Since it happens that traffic charges may be either high or low, according as the administration is primarily influenced by economical considerations or the contrary, it is important to endeavour to discover how far private companies' lines compare in this item with lines that are controlled by the State. The materials for such a comparison are to be found in the railway returns of the chief Continental countries, and are presented in the following abstract. In a general way, it will be observed that there is not really much difference between the private and the State lines as regards Germany, Austria, Denmark, Holland, and Italy. In Russia, however, the private lines run their traffic expenses up to 21.34 per cent. of the whole, as against only 11.83 per cent. on the State lines; and in Roumania the State lines have also considerably the advantage over the others. France supplies an equally

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notable example of the superior economy of State control; but in Germany, on the contrary, the State lines show the higher percentage of the two. In considering these figures regard should, of course, be had to the general conditions under which the traffic is worked, and the descriptions of traffic that preponderate, in each country.

Statement showing the Percentage Proportions of Total Working Expenditure of Continental Railways, incurred in respect of Traffic Expenses on State and Private Companies' Lines respectively.

Countries.	State Lines.		Private Lines.	
	Per Kilometre.	Percentage of Total.	Per Kilometre.	Percentage of Total Expenditure.
	francs.	per cent.	francs.	per cent.
Germany .	7,017	37.80	4,476	35.30
Austria .	3,272	29.03	5,438	32.54
Belgium .	6,505	25.96	4,322	32.79
Denmark .	1,860	29.33	2,901	27.01
France .	2,342	27.57	8,524	34.77
Italy . .	7,220	35.98	4,704	31.84
Norway .	949	24.56	3,948	30.32
Holland .	4,481	36.90	6,315	35.53
Roumania .	2,415	22.70	3,619	28.40
Russia .	2,737	11.83	5,439	21.34

Briefly, the above figures show that the expenses incurred in respect of working the traffic, other than locomotive power (called in English Board of Trade returns traffic expenses), are higher on State lines in Germany, Denmark, Italy, and Holland, and lower on the State lines of all the other countries.

Among the many items that have been added to the traffic expenses within recent years, there are two that Parliament has compelled railway companies to adopt in the interest of the public safety. The first of these is the block system. The second is continuous breaks.

There is no record of the exact amount that these two systems have added to the working of British railways.

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The increased expenditure which they have involved can only, therefore, be arrived at by inference or calculation.

The experience of the London and North-Western Railway Company is, however, set forth in one of their recent reports so specifically that we cannot be far wrong in accepting it as a guide to the experience of railways in general.

The sum of £750,000 had been spent upon the construction of block signals and stations by the company just named, up to the end of 1877. The expenditure on fitting continuous breaks (on the Clarke-Webb system) to the rolling stock of the same company had been about £100,000.

In addition to this capital outlay, the London and North-Western directors report that "the wages of the additional men required for working the block signals and stations amounts to £50,000 a year, which, with the interest on outlay, renewal, and maintenance of signals, stores, and other incidental expenses, represents an extra annual expense of little short of £200,000 per annum."

Adopting these figures as a basis of estimation, it would appear that the additional capital expenditure entailed by the block system on the present railway mileage of the United Kingdom would be £8,601,000 sterling, or a fraction over one per cent. on the total railway capital expenditure of the country.

Assuming, however, that the cost of maintenance of the block system was the same throughout the country generally as in the special case of the London and North-Western system, the additional annual expenditure involved would be a trifle over 2¼ millions sterling, or roughly, about 6.3 per cent. of the total working expenditure of all the railways of the United Kingdom in 1884.

Again, it has been stated that the cost of the general adoption of continuous brakes on the North-Western system has been about £100,000. This amounts to

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about £60 per mile, and if the same average is adopted for the whole railway mileage of the three kingdoms, the total additional capital expenditure involved by this compulsory enactment would be £1,131,840. The total additional expenditure necessitated by both requirements would, therefore, be not less than 9¾ millions sterling.

That there are considerable reductions possible in the working of railway traffic is sufficiently obvious. Generally speaking, it may be claimed that the lines that show the highest outlay under this head are the lines that afford the greatest facilities to the public. But a very great deal of such expenditure might be got rid of if there was less competition between one line and another for traffic that is probably remunerative to none under existing conditions.

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CHAPTER XVI.

EXTENT AND CHARACTER OF RAILWAY PASSENGER TRAFFIC.

To most people the habitual use of the railway as a means of getting from place to place is so much a part and parcel of their everyday lives that they do not stop to inquire how our forefathers got along in the absence of railways, or what is the extent of this influence on the economy of their existence. A glance at these points may not inappropriately introduce us to the more modern aspects of our subject.

The retrospect need not necessarily be carried very far back. Up to the year 1830 the speed that could be maintained in railway travelling depended mainly on the previous adoption of three mechanical inventions—the shoeing of horses, the application of steel springs to carriages, and the formation of roads of a homogeneous surface.[1] From seven and a half to eight miles per hour was then regarded as a fair stage-coach speed. The quickest travelling of that day was sixteen miles an hour.

For a number of years after the first introduction of railways, the speed of travelling was limited to less than twenty-five miles an hour. By-and-by this speed was increased to thirty, and ultimately to forty, miles per hour. Under special circumstances, Mr. Crampton obtained over fifty miles an hour between London and Birmingham in 1847, and Brunel ran on some parts of the Great Western

[1] *Edinburgh Review*, 1876, p. 357.

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line, some years later, at seventy miles an hour—a velocity equal to that of a swift on the wing. Nowadays most of our express trains travel at a speed of forty-five to fifty miles an hour, and some of them at a still higher velocity.

The effect of the development of speed in railway travelling has thus been described by a recent writer of high authority:—

"The great bulk of railway passengers now travel by third-class carriages, and thus represent the wagon and cart, and the pedestrian, travellers of the days of coaching; while the first and second class passengers may be compared with those who formerly made use of private carriages, postchaises, and fast coaches. We shall be far within the mark in assuming that each of these individual journeys has been performed in one-fourth of the time that would have been possible in the absence of railways. Of course the mere number of journeys, irrespective of their rapidity, would have been inconsistent with our industrial condition half a century ago. The increase of speed is one of the elements which have rendered possible the actual number of journeys now taken, with which, as a fact, we have to deal.

"If we allow, then, that in each passenger journey taken on our railways in the past year,[1] forty minutes less time has been occupied than would have been consumed in the performance of such journey by the old methods, the aggregate of time thus calculated is somewhat more than 1,500,000 years, allowing a working year to consist of 300 days of eight hours a piece. The total number of persons occupied in professions, industry, and commerce in England is returned, in the census of 1871, as 6,637,331 persons. The returns from passenger traffic in England are something more than 85 per cent. of the total passenger income from the railways of the United Kingdom.

[1] This applies to 1876, when 534½ million passengers were carried on the railways of the United Kingdom. In 1884, however, the number carried had increased to 695 millions.

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This gives a relative aggregate of 1,275,000 years for the gain of England alone, which is equivalent to an addition of rather more than one-fifth to the working time of each industrial individual. Thus, as far as the time actually occupied in travelling is an indication of the useful occupation of the productive classes in England, one-fifth has been added to the economic power of our population by the use of railways for passenger traffic; a fact which may very well allow a very wide margin for travelling merely for luxury or for amusement."

So far as these calculations describe the economy effected by the introduction and general adoption of railway travelling, they will, of course, be found to affect in the highest degree that nation in which the community makes the most general use of railways, and in the least degree the nations that show the lowest ratio of railway travelling to population.

From this point of view, then, it is important to consider how far the different leading countries of the world have taken advantage of the opportunities for the economy of time and labour which the railway system has so bountifully placed within their reach.

The first statement that we shall make use of for this purpose is one that shows the proportions of first, second, and third class travellers carried in each European country in the year 1882:[1]—

[1] In the United States there is no such distinction of railway travellers, so that we cannot include that country in this table.

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Statement showing the Number of Passengers of each Class Carried in Different Countries in 1882 (1 = 1000).

Countries.	Number of Passengers Carried of each Class.				Totals.[1]	Percentage of Third-Class Passengers on Total.
	First.	Second.	Third.	Fourth.		
Germany	2,180	28,904	144,620	48,338	232,564	62
Austria-Hungary . . .	616	6,232	34,180	4,454	47,212	73
Belgium	2,264	6,696	44,184	...	53,300	83
Denmark	54	1,067	6,186	...	7,037	86
Italy	1,983	8,958	23,060	271	34,271	67
Norway	6	287	2,143	35	2,471	87
Holland	1,351	4,024	10,448	9	17,151	61
Roumania	74	263	967	...	1,403	69
Russia	748	3,473	31,530	1,459	37,210	85
Finland	25	361	1,382	...	1,813	70
Switzerland	365	4,069	18,223	...	22,658	80
Totals and average .	9,666	64,334	316,922	54,566	457,090	69
United Kingdom . . .	34,582	62,265	598,144	...	694,991	86

[1] The totals do not always make up the sum of the four preceding items, inasmuch as they do not always include military, &c., which in most European countries are carried at reduced rates.

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This table scarcely seems to bring out clearly the relation of third-class passengers to the total travel that might have been expected for the countries tabulated. On the contrary, it is full of surprises. It shows that third-class travel is more general in the United Kingdom than in any other European country, the average of passengers of that class being 86 per cent. in our own land, as compared with only 69 per cent. for eleven Continental countries. It would, however, have been natural to look for the greatest amount of travelling of an inferior class in the poorest countries, where the people, presumably, could least afford to use higher-priced accommodation; and in that case, Italy, Roumania, and Finland, which show a considerably higher percentage of superior travel than England, would have had their relative circumstances reversed. There is, however, an adequate explanation, which will readily suggest itself. The Continental lines do not, as a rule, provide the same facilities as the English for third-class travellers; and then, again, in some European countries, it is only the better-off who travel at all, whereas there is none so poor in England that he does not sometimes make use of the rail.

This latter argument appears to receive a most remarkable support from the statistics of travel in European countries, relatively to population. It will be observed that in our own country the number of travellers is in excess of that of all the rest of Europe put together.[1] This relation of population to railway travel is so interesting that we have thrown the returns for the principal European countries and the United States into the form of a short table:—

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[1] In this statement we have included France, which had a total of 204 million railway travellers in 1883, bringing up the total of Continental Europe to about 662 millions, against a total of 695 millions for the United Kingdom.

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Statement showing the Relation of Railway Travelling to Population in the Chief Countries of Europe in 1882, and in the United States in 1883.

Countries.	Population (1=1000).	Number of Railway Passengers (1=1000).	Number of Railway Travellers per Head of Population.
United States	50,152	269,583	5.4
Germany	45,234	232,564	5.1
France	37,321	204,700	5.5
Belgium	5,720	53,300	9.3
Russia (in Europe)	86,359	37,210	0.4
Austria-Hungary	37,800	47,412	1.2
United Kingdom	36,468	694,991	19
England	25,480	621,131	25
Scotland	3,661	54,305	15
Ireland	5,327	19,555	3.6

It is clear, then, that the United Kingdom, and England and Wales in particular, are immeasurably in front of the rest of the world in reference to their habitual use of the rail. Scotland, however, comes greatly behind England, and Ireland a long way behind both. In no case are season-ticket holders included in this calculation, otherwise the pre-eminence of the United Kingdom would be still more manifest.

The total number of travellers does not, of course, afford an infallible index to the amount of travelling done, since the average distance carried may be much less in one country than in another. But the position which we have already found England to occupy is certified, in a marked degree, by the following return of the average receipts from railway passenger traffic per head of the population in different countries:—

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Statement showing the Total Receipts from Passenger Traffic in Different Countries, and the Average Receipts per Head of the Population.

Countries.	Receipts (£1 = 1000).	Population (1 = 1000).	Average per Head of Population.
	£		s.
Germany	12,216	45,234	5.4
Austria-Hungary	4,827	37,800	2.6
Belgium	1,705	5,720	5.9
France	13,425	37,321	7.6
Denmark	359	1,969	3.6
Italy	3,176	28,459	2.2
Holland	1,073	4,225	5.1
Roumania	335	5,376	1.2
Russia	7,229	86,359	1.7
Switzerland	1,094	2,846	7.7
United States	28,820	50,152	11.4
United Kingdom	25,160	36,400	13.8

It will be observed that although in the United States the number of railway travellers is only 5.4 per head of the population, as compared with 19 in the United Kingdom, yet the average expenditure per head is 11.4s. as compared with 13.8s. in the United Kingdom. This fact may be taken to prove the much greater average length of journey in the United States, since the range of fares is not materially higher, if at all.

There is, however, still another test to which the general incidence of railway travelling in different countries may be subjected. The railways, as such, are not so much interested in the more general economic aspects of the question under consideration, as in the problem of how far they can develop traffic relatively to their mileage and their capital expenditure. The first of these two is a very important question, as bearing not only upon the point of how far the population of each country takes advantage of the facilities for locomotion provided for it, but also upon the further point of how far such facilities are equal to the requirements of each particular country.

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The United Kingdom has the greatest passenger traffic per mile of line open of any country in the world, and derives correspondingly large receipts therefrom. It will be observed in the following return that the number of passengers carried per mile was 37,000 in the United Kingdom, as against 28,276 in Belgium, 12,198 in Holland, 12,045 in France, and 10,571 in Germany, these being, in the order given, the next largest passenger-carrying countries relatively to their mileage.

Statement showing the Number of Passengers Carried on the Railways of Different European Countries, and the Average Number per Mile of Line Open.

Countries.	Miles Open.	Number of Passengers Carried (x = 1000).	Average Passengers Carried per Mile.
Germany	21,785	232,564	10,571
Austria-Hungary	12,603	47,212	3,632
Belgium	1,885	53,300	28,276
Denmark	926	7,037	7,599
France	16,578	204,758	12,045
Italy	5,871	34,271	5,712
Norway	970	2,471	2,547
Holland	1,406	17,151	12,198
Roumania	899	1,403	1,561
Russia	14,226	37,210	2,658
Switzerland	1,795	22,658	12,623
Totals and average	78,944	660,035	8,355
United Kingdom	18,864	694,991	37,000
United States	87,781	269,583	3,070

The United Kingdom, as we have already seen, differs from most other countries in respect of the average distance over which each passenger is carried. There is, however, no standard by which we can test the average length of each passenger journey on British railways, owing to the absence of any record of the passenger mileage. In the United States the number of passengers

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carried one mile in 1880 was 5740 millions, and as the total number of passengers carried was 269½ millions, it follows that the average length of each passenger journey was 21.3 miles. The highest average mileage was in the Pacific States; the lowest in those of New England, as the following figures show:—

Statement showing the Number of Passengers Carried on the Railways of the United States in 1880, with the Numbers Carried One Mile, and the Average Distance Travelled by each Passenger.

Group of States.	Number of Passengers Carried (1 = 1000).	Number of Passengers Carried One Mile (1 = 1000).	Average Distance Travelled per Passenger, Miles.
New England . .	52,156	875,102	17
Middle	175,276	3,051,158	17
Southern	7,463	329,481	44
Western	22,860	956,234	42
South-Western . .	394	15,707	42
Pacific	11,432	512,427	45
Totals and average .	269,583	5,740,112	21.3

On the Continent of Europe the average length of journey varies from a maximum of 106.45 kilometres in Russia to a minimum of 10.63 kilometres on the local lines of France. The following statement shows the average length of passenger journeys on the State and other lines of the principal European countries in 1882:—

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Statement showing the Number of Passengers Carried on the State and Private Railways of Different European Countries, and the Average Distance Travelled by each Passenger.

Countries.	Number of Passenger Train, Kilometres.	Number of Passengers Carried.	Average Distance Carried per Passenger, Kilometres.
Germany—			
State lines	5,558,195	184,636	30.10
Private lines worked by the State	485,000	14,745	32.85
Companies' lines	923,696	33,181	27.82
Totals	6,966,893	232,563	30.02
Austria—			
State lines	241,680	4,954	...
Companies' lines	1,965,796	42,256	...
Belgium—			
State lines	1,018,271	47,986	21.22
Private lines	97,020	5,313	18.26
Denmark	214,810	7,306	29.40
France—			
State lines	260,919	8,553	30.50
State lines worked by companies	57,599	3,446	16.84
Private lines	6,443,988	182,863	35.27
Local lines	105,202	9,895	10.63
Italy—			
State lines	807,195	18,115	44.56
Private lines	1,656,091	34,271	48.32
Luxembourg	6,713	438	15.00
Norway	62,218	2,167	28.71
Holland	484,582	17,151	28.25
Roumania	105,336	1,402	75.13
Russia	3,961,112	37,209	106.45
Switzerland	498,772	22,657	22.01

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CHAPTER XVII.

FINANCIAL ASPECT OF COACHING OR PASSENGER TRAFFIC.

THERE are two aspects of the passenger traffic of railways that appear to demand paramount consideration in any analysis of railway control. The first is that of how far there is adequate provision made by the railways of the country as a whole for encouraging and developing traffic of this kind; the second, that of the return that is earned upon this traffic, considered *per se*.

In some quarters there is a rather strong feeling that the railways of the United Kingdom are not over successful in either respect—that they do not give the utmost facilities for fostering a traffic which has had largely to be created, and that they give certain facilities that are not really required, in such a way, and to such an extent, as to yield returns the reverse of satisfactory to their shareholders.

It is not quite so easy a matter as it might at the first blush appear to bring this question to the test of actual figures. The difficulty is very much increased in the case of the United Kingdom, seeing that, although the passenger traffic receipts are separately distinguished, yet the expenditure incurred in working this description of traffic is not ascertainable.

There are, however, several sides from which the problem may be attacked in such a way as to throw light upon its character and tendencies, if not quite to

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lighten the darkness in which the present system of making out railway accounts is calculated to envelop it. The first of these to which we propose to call attention is that of the gross and the net passenger traffic per mile.

In the early history of the railway system the passenger traffic was much more valuable than goods or general merchandise, and that notwithstanding the fact that the earliest railways were constructed mainly with a view to the transport of goods traffic.[1] In 1843, the gross value of the passenger traffic of England per mile amounted to £1729, as compared with £792 for goods traffic. In 1869, the passenger traffic only reached an average of £1063 per mile, as compared with £1463 per mile for goods traffic. In 1884, the passenger traffic amounted to £1370 per mile, and the goods and mineral traffic to £2000 per mile.

It is manifest, therefore, that a very radical change has come over the relative character and value of passenger and goods traffic within the last thirty years. This change has been increasingly marked within the last ten or fifteen years. In 1869, the proportion of the total receipts of our railways received from passenger traffic was 46 per cent.; in 1884, it had fallen to 42 per cent.

There is, however, a somewhat remarkable difference in the relation of passenger to goods traffic in the three divisions of the United Kingdom. In England and Wales, passengers contribute 43 per cent., and general merchandise 57 per cent., of the whole gross receipts; in Scotland, passengers only supply 39 and goods 61 per cent.; while in Ireland, again, passenger traffic rises to

[1] The original Stockton and Darlington Railway, the pioneer passenger line, was designed at first only for the transport of coal from the collieries in South Durham to the Tees ports. The sole object of the promoters of the Liverpool and Manchester Railway, as originally designed, was the transport of merchandise between these two towns.

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55 per cent., and goods traffic falls to 45 per cent., of the total.

For the reason already mentioned—the absence of any specific record of the profits derived from each of the two main sources of traffic—it is impossible to estimate the proportions of the total net receipts which they respectively furnish.

In most European countries, and in almost all new countries in which the railway system has not reached a high state of development, the passenger traffic will generally be found to be the more important of the two. It would seem to be an almost invariable principle, in regard to railway affairs, that the goods traffic takes a rather longer period to mature, while passenger traffic undergoes immediate development. The United States would appear to be a singular exception to this rule. In that country, the passenger receipts averaged, in 1883, £428 per mile, against an average of £1130 for goods receipts. The passenger traffic is thus infinitely the less important of the two, since the goods traffic yields about 170 per cent. more gross revenue per mile of line open.

There is, as we have already seen, this further exceptional feature about the passenger traffic of the United Kingdom, that it is larger in point of the numbers carried per mile of line open than that of any other country in the world. This might, of course, be almost expected, from the density of the population, but not to the extent that is really the case. Belgium is almost on all fours with England as regards density of population, and yet it appears that in England the number of passengers carried is nearly 9000 per mile open more than in Belgium.

The differences that distinguish the several leading countries of the world, in reference to the gross receipts per train mile, naturally suggest the reflection whether there is any reason, in the nature of the case, causing

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one country to be superior to another in this result, and whether there may not possibly be some defect of control or system to account for the lower range of train mile receipts in the United Kingdom.

There are two obvious considerations that occur in examining this problem—the first, that train-mile receipts may be increased by higher fares, or by a large proportion of first and second class passengers; the second, that the same result may be produced by taking care to secure as far as possible full train-loads, or, in other words, to avoid running so many trains.

There is not, perhaps, much reason, on the whole, to think that the passenger fares in England are greatly above the average of other countries. There is, however, no exact process whereby to put this matter to a test. The only reliable method of estimation would be to obtain from the railways of each country the total number of passengers of each class carried one mile, together with the receipts therefrom, and then divide the passenger miles into the receipts for each class, in order to get the true average fares per mile in respect thereof. But in the absence of this desirable standard of comparison the matter is left largely to conjecture.

It is not so, however, with the proportions of passengers that travel in different classes. This is given for every important European country, including our own, and we are thereby enabled to calculate the probable influence of higher-classed travel in affecting railway passenger receipts.

The first point that strikes an inquirer into this subject is the remarkable proportion of increase in the receipts from third-class travel within recents years. In 1845, the total receipts from passenger traffic in the United Kingdom was about four millions sterling, of which only £622,000 were derived from third-class travel, being about 16 per cent. of the whole. In 1861,

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passenger traffic yielded about 9¾ millions sterling, of which 3½ millions, or 36 per cent. of the whole, were earned by third-class travel; but in 1881, the porportion of total passenger receipts contributed by third-class travel had advanced to 64 per cent. This movement is still making progress, as the following statement of the receipts from passenger traffic from 1874 to 1884 will clearly show:—

Statement showing the Receipts from Passenger Traffic in the United Kingdom, and the Total Percentage Proportions thereof Received from Third-Class Travel, 1874–1884.

Years.	Total Receipts from Passengers (£1 = 1000).	Receipts from Third-Class Passengers (£1 = 1000).	Receipts from First-Class Passengers (£1 = 1000).	Percentage of Receipts from Third-Class.
1874	£18,772	£10,523	£3,785	56
1875	19,364	11,082	3,982	57
1876	19,623	11,624	3,816	59
1877	19,846	11,934	3,669	60
1878	20,047	11,172	3,568	56
1879	19,340	11,921	3,219	62
1880	20,341	12,750	3,250	63
1881	20,689	13,232	3,138	64
1882	21,572	14,108	3,088	65
1883	22,059	14,703	2,998	67
1884	22,247	15,207	2,833	68

In some other European countries the receipts from the different classes of passenger travel are not distinguished, so that a table that would show for all other countries figures corresponding to those above would be difficult to construct; but the information is given in another, and perhaps equally effective, form, in the preceding chapter, where the percentage of third-class travel on the total is shown for each country.

The extraordinary increase in third-class travel in the United Kingdom is due in great part to the better facilities afforded by the railway companies for passengers of this description, and these better facilities are

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found alike in the speed of the trains, the number of trains available, and the accommodation provided in the carriages. The English lines now, beyond all comparison, make the best provision for the lowest class of travellers, and their action in this regard has been rewarded by an expansion of traffic which, a few years ago, would hardly have been believed possible.

The usual parliamentary fare in the United Kingdom is a penny per mile. Whether the railways in general have made any abatement on the statutory fares within recent years it would be difficult to determine from the limited *data* afforded on this point. But that there has been a general reduction in the average amount paid for each third-class ticket is shown by the following table, which compares the first and the third class fares for a period of fourteen years, although it is to be noted that the reduction of .4s. in the former and of .7d. in the latter *may* be due to the shorter average of the journeys made:—

Statement showing the Total Number of First and Third Class Passengers Carried in England and Wales in the Period 1870–84, the Total Receipts therefrom, and the Average Fares per Passenger.

Years.	Number of First-Class Passengers (1 = 1000).	Receipts therefrom (£1 = 1000).	Average per Passenger.	Number of Third-Class Passengers (1 = 1000).	Receipts therefrom (£1 = 1000).	Average per Passenger.
		£	s.		£	d.
1870	27,682	3,329	2.4	199,133	6,177	7.4
1872	32,015	3,655	2.3	275,470	8,681	7.6
1873	32,474	3,688	2.3	306,124	9,941	7.8
1874	33,099	3,785	2.3	325,655	10,523	7.8
1875	37,136	3,983	2.1	350,859	11,082	7.6
1876	36,786	3,816	2.1	383,191	11,624	7.3
1877	36,105	3,670	2.0	396,110	11,934	7.2
1878	34,737	3,568	2.1	411,683	12,172	7.1
1879	32,591	3,219	2.0	414,610	11,921	6.9
1880	32,097	3,250	2.0	450,677	12,750	6.8
1881	31,576	3,139	2.0	471,696	13,233	6.7
1882	30,777	3,088	2.0	497,124	14,109	6.8
1883	29,897	2,998	2.0	523,420	14,702	6.7
1884	28,234	2,834	2.0	537,582	15,207	6.7

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If the average first-class fare is assumed at 2d. per mile, and the average third-class fare at 1d., it would follow that the former represented an average of 12 miles, and the latter an average of 6¾ miles, per passenger journey. These averages, as we have elsewhere shown, are much under those of Continental countries and the United States.

It is also to be observed that in the majority of Continental countries, and in the United States as well, the average receipts per passenger carried have been reduced within recent years. The movement which we have already found to have been characteristic of English passenger traffic has, therefore, been a general one, and as, in foreign countries, it has been coincident with, and created by, a lower tariff of fares, it is to be presumed that, in regard to passengers, as in regard to merchandise, the economies effected in the working of railways, and the greater volume of traffic dealt with, have enabled a lower range of fares to be adopted.[1]

In the United Kingdom the average earnings per passenger carriage were reduced, between 1874 and 1884, from £888 to £797, or 10 per cent. Concurrently with this movement, the number of carriages for each 1000 passengers rose from 20 to 22. It appears, therefore, that the increase in the number of carriages relatively to the number of passengers carried had something to do with the decreased receipts per carriage, but a more potent factor is likely to have been the larger proportion of third-class carriages.

The increase in the proportion of third-class passengers, to which attention has been directed, is mainly a product of the last decade. In 1845, the number of third-class passengers carried in England and Wales was only 39 per cent. of the total. But in 1861 the proportion had

[1] The average fare per passenger carried in France was 2.5s. in 1872, and 2.0s. in 1883.

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grown to 56 per cent. In 1874, as we have already seen, it had not passed the latter figure, whereas within the next ten years 68 per cent. of the whole number transported were third-class passengers.

In Russia, the proportion of the total passenger receipts received from third-class travel is larger than it is in the United Kingdom, amounting, as it did, to 71 per cent. in 1883. In Belgium, only 61 per cent. of the total passenger receipts are derived from the same source, and in other European countries third-class travel contributes less than 60 per cent. of the total passenger receipts, as compared with 68 per cent. in the United Kingdom. For eight Continental countries, the proportion of the total passenger receipts received from third-class travel in 1883 was 54 per cent., as the following figures show:—

Statement showing the Receipts from Different Classes of Passenger Traffic in Continental Countries (1 fr. = 1000).

Countries.	First Class.	Second Class.	Third Class.	Totals.	Percentage of Total Receipts Received from Third Class.
	francs.	francs.	francs.	francs.	
Germany .	17,432	89,230	146,318	305,404	48
Austria .	8,602	34,515	67,606	120,676	56
Belgium .	6,670	9,893	25,900	42,624	61
France .	No distinction is made on many lines.				
Denmark .		Do.	do.	do.	
Italy . .	15,659	28,630	34,942	79,400	44
Holland .	4,746	9,504	10,957	26,818	41
Roumania .	1,232	2,327	4,149	8,373	50
Russia . .	12,420	32,612	128,449	180,738	71
Switzerland .	2,233	9,427	15,678	27,338	57
Totals .	68,994	216,138	433,999	791,371	54

These comparative returns suggest some interesting problems, both social and economic. Can it be that the nations of Continental Europe, which are generally much poorer than England, are, after all, accustomed to travel in a superior class? Or is it that the English people

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are more thrifty, and prefer to use the third class for economical reasons? Or is it that the superior facilities for third-class travel in England attracts, while in other countries the absence of such facilities repels, travellers of humble means? The last-named, we believe, will be found to be the true reading of the riddle. The system generally adopted on the Continent tends to *force* travellers into a superior class. Third-class trains are invariably extremely slow. Third-class carriages are, as a rule, extremely bad. Continental nations, in a word, continue to follow a course that was practised in England for many years, but has now generally been abandoned—they have compelled their population to travel just as little as they possibly could, and have thus prevented that enormous expansion of traffic which the more wise and liberal policy towards third-class passengers adopted by English railways within recent years has done so much to create.

If anything more were wanted to prove that railways can create, as well as nurse and facilitate, a traffic, it may be found in the following statement of the average of the passenger fares, the receipts per mile of line open, the receipts per passenger train mile, and the receipts per head of the population of England and Wales at intervals between 1851 and 1884:—

Passenger Receipts—England and Wales.

Years.	Average Fare per Head.	Average Receipts per Mile of Line Open.	Average Receipts per Passenger Train Mile.	Passenger Receipts per Head of Population.
	s. d.	£	*s. d.*	*s. d.*
1851	1 11½	1,304	4 6¼	7 7¾
1861	1 4	1,240	4 4	9 7
1871	0 10¾	1,363	4 0¼	13 0¼
1873	0 10¼	1,501	4 3¾	15 0¼
1874	0 10¼	1,535	4 4¼	15 8½
1878	0 9¾	1,640	4 2½	16 2
1883	0 8½	1,669	3 9	16 5
1885	0 8¾	1,629	3 7	15 11

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Passenger Fares.

It has already been admitted that, as compared with most Continental countries, England gives facilities for passenger traffic that are much to be commended. But the average range of passenger fares is still higher than in most Continental countries. This is not a new feature of English railway administration. On the contrary, it is one that has obtained for many years, although probably few are aware that the difference is so great as it really is.

Mr. Edwin Chadwick gave the following as the average first, second, and third class passenger fares in the years and countries specified:[1]—

Countries.	Years.	Average Fares per Mile.		
		First Class.	Second Class.	Third Class.
		d.	d.	d.
England . . .	1857	2.01	1.41	.87
France . . .	1854	1.55	1.16	.84
Belgium . . .	1856	1.33	1.00	.65
Prussia . . .	1857	1.4	1.15	.77
Austria . . .	1857	1.4	1.1	.83

These figures do not, of course, equally apply to the present time, but perhaps the present relation of English fares to those of other countries will not greatly differ from that shown above. In other words, English fares are still generally 25 to 35 per cent. higher than those of Continental Europe, and they are higher still when compared with the United States.

The following statement shows the average receipts per passenger per kilometre on the principal Continental railway systems in 1883:—

[1] Evidence before the Royal Commission on Railways in 1866, p. 851 of Report.

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Statement showing the Average Passenger Fares in Continental Countries in 1883.

Countries and Railways.	Average Fare Paid per Passenger.	Average Fare per Kilometre.	Average Passenger Receipts per Kilometre.
	francs.	centimes.	francs.
Germany—			
State lines	1.33	4.39	9,826
Private lines worked by State	1.26	3.79	6,136
Companies' lines	1.25	4.43	6,810
Austria—			
State lines	2.85	5.42	3,782
State lines worked by companies	1.38	4.42	1,923
Private lines worked by State	1.99	5.61	6,382
Companies' lines	2.67	5.46	7,324
Belgium—			
State lines	0.80	3.81	13,010
Companies' lines	0.73	4.04	5,595
Denmark	1.22	4.18	5,653
France—			
State lines	1.19	3.89	3,925
State lines worked by companies	0.82	4.88	2,362
Companies' lines	1.68	4.86	12,771
Local lines (private)	0.69	6.49	3,154
Italy—			
State lines	2.36	5.30	11,931
Companies' lines	2.31	4.80	8,830
Luxembourg	0.56	3.69	1,850
Norway	1.25	4.38	2,282
Holland	1.56	5.53	13,737
Roumania	5.97	7.95	6,377
Russia—			
Companies lines'	4.87	4.68	5,793
State lines	4.86	4.88	8,018
Switzerland	1.21	5.48	9,963

According to the above figures, the lowest average fares on the Continent are found in Germany, Luxembourg, Belgium, and France, while the highest are found in Roumania, Holland, France (local lines), and Austria. Between the maximum of 7.95 and the minimum of

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3.69 centimes per kilometre, there is a difference by increase of 116 per cent. This difference is to be explained to some extent by the varying proportions of first and third class travel; but even when this element has been fully regarded, there remains a very remarkable, and not easily explicable, difference. The general range of fares on the railways of France, Germany, and Belgium is, on the whole, pretty uniform. From this generalisation the local lines of France are excepted. On these, the average fare per kilometre rises to 6.49 centimes. This is nearly 70 per cent. higher than the average found for the State lines. In all cases of difference, very much depends upon the extent to which first-class travel is resorted to.

On fifteen of the leading railways of the United States, the average fare per passenger per mile in 1880 was 2.43 cents, or nearly 1¼d. These fifteen lines carried 25 per cent. of all the passengers who made use of the railways of the United States in that year, so that the average is a fairly typical one. It is, however, made up of very variable elements. The lowest average fare is that on the New York Central, which amounted to exactly two cents (1d.) per mile. The highest fare was 6.06 cents (3d.) per mile, on the Atchison, Topeka, and Santa Fé line. The former line carried 8,270,000, the latter only 359,000 passengers. On the Pennsylvania railways the average fare was 2.42 cents (rather under 1¼d.) per mile, which is just a fraction below the average of the fifteen lines in question.

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CHAPTER XVIII.

THE ECONOMICAL WORKING OF PASSENGER TRAFFIC.

It is a much debated question whether passenger traffic or the transport of goods is the more remunerative to a railway. It is an equally moot point whether the working of passenger traffic, at any rate in Great Britain, is as remunerative as it might and ought to be.

One authority maintains that the transport of goods, and especially of minerals, is not only not remunerative, but is carried on at a positive loss.[1] Another authority makes the claim that goods, and especially mineral, traffic is the most lucrative, and that both are made to pay for losses incurred in passenger transport.[2]

The problem that we have undertaken to consider in this chapter is, therefore, one of the most knotty and unsettled points in railway administration.

The subject is rendered difficult and complicated by reason of the fact than in no country is there adequate *data* at command for its complete elucidation. All countries alike compile and issue returns of their gross earnings, which are separately distinguished as regards goods and passengers. All countries equally compile and issue returns of their working expenses and net earnings. But no country shows, as regards its total railway traffic,

[1] "Railway Profits and Railway Losses," in the *Edinburgh Review*, 1876, p. 367.

[2] Mr. R. Price Williams on "Economy of Railway Working," *Proceedings of the Institution of Mechanical Engineers*, 1879.

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the proportion of working expenditure due to passengers as distinguished from goods; nor is there any case within our knowledge in which the proportions of the net earnings severally due to goods and to passengers are separately recorded.

It is, therefore, necessary to calculate—or more generally to guess at—the proportion of the total cost of working a railway that falls to passenger traffic. Whether that proportion is larger or smaller, whether the net proceeds are greater or less, we have no absolute knowledge. In other words, although we know the net profits derived from railway working, in reference to all railways and all countries alike, we cannot specify how much passenger traffic has contributed, nor, for the matter of that, whether it has contributed any at all.

There are, as might be expected, many essential differences as between goods and passenger traffics. The latter is usually conducted at much greater rates of speed; the trains are of a much more composite character, and are not generally so fully loaded. The permanent way requires to be kept in much better condition, with a view to greater security of life and limb. The ordinary station expenses are incurred mainly for passenger traffic, and so with the expenses incidental to the block system, to air-brakes, and to many other items of working cost.

It will not, therefore, be expected that the relation of revenue to the nominal services rendered will be the same in the cases of the two descriptions of traffic. If we bring this matter to the standard of weight carried, the difference becomes enormous. In 1884, the railways of the United Kingdom carried 695 millions of passengers, not including season-ticketholders, who—assuming that each made 200 journeys in the year—would bring up the total to 848 millions. Allowing, now, that fifteen passengers weigh one ton, this would represent not less than 57 millions of tons. For the transport of this passenger tonnage, the railways received, in round figures, 26 millions sterling, being an

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average of about 9.1s. per ton. Now, we have good reason to believe, as we have shown in a previous chapter, that the average distance over which each passenger is carried in the United Kingdom is between seven and twelve miles, but certainly not more than the latter figure; and if we take the mean of the two sums, we shall find that the average receipts of our railways per ton of passengers were practically about a shilling a mile, as against an average of not more than 1¼d. to 1⅝d. per ton per mile for goods traffic. On this showing, therefore, it costs approximately nine times as much to convey a ton of passengers as it does to convey a ton of minerals.

One obvious reason for this fact, apart from the manifestly different circumstances of the traffic in other respects, is the great liability that exists on British railways to dispatch only partially loaded, and, in many cases, almost empty carriages.

It is by no means an easy matter to determine the exact position of British railways in this regard. The Board of Trade publishes statistics of the number of passenger carriages owned by each company, and of the total number of passengers carried, and it might be supposed that by dividing the one sum into the other we would get at the comparative economy or absence of economy with which the passenger traffic of each was conducted, as tested by the number of passengers annually carried per carriage. But this standard of comparison is open to several manifest objections. In the first place, the result is liable to be affected by the comparative numbers of first, second, and third class carriages, and the proportions of first, second, and third class travellers. In the next place, it is obviously open to the limitations imposed by the average rates of speed. And, finally, it is necessarily largely, and indeed absolutely, qualified by the average distance over which each passenger is carried, since it need not be pointed out that a carriage that carried 10,000 passengers an average distance of thirty miles each would have rendered more

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service than another that only carried 20,000 passengers an everage distance of ten miles.

It is necessary to bear these considerations in mind in examining the following statement of the number of passengers carried per carriage on the railways of the United Kingdom in the period from 1872 to 1885:—

Statement showing the Total Number of Passengers Carried per Passenger Vehicle in each Year from 1872 to 1885.[1]

Years.	Passenger Carriages.	Number of Passengers Carried (1=1000).	Average Passengers per Vehicle.
1872	23,569	422,874	17,942
1873	24,634	455,320	18,483
1874	25,441	477,840	18,782
1875	26,204	506,975	19,347
1876	27,191	534,494	19,657
1877	27,729	549,541	19,818
1878	28,104	565,024	20,105
1879	28,797	562,732	19,541
1880	29,565	603,885	20,626
1881	30,489	626,030	20,533
1882	31,250	654,838	20,955
1883	32,304	683,718	21,163
1884	33,031	694,991	21,040
1885	33,656	697,213	20,802

So far as they go, these figures would appear to show that there has been an improvement in the economy of passenger transport over these thirteen years. But it must not be forgotten that in the same interval the percentage of third-class travel has increased from 55 to 68 per cent. of the total passengers carried. This fact becomes of paramount importance when we remember that, in a general way, a first-class carriage weighing seven tons will seat thirty-six passengers, while a third-class carriage will seat fifty,[2] and that the proportion of seats occupied in the latter is generally in excess of that occupied in the former. It is not, of course, pretended that the weights

[1] This table does not include season-ticketholders.

[2] This is the accommodation provided in the carriages on the North London line.

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and capacities of carriages indicated are of universal application. These, indeed, vary as much as the types and weights of locomotives and wagons. But the figures may be accepted as expressing in a fairly accurate manner the relation of the capacities of the several classes of carriages to each other. On the main trunk lines, the average is sometimes higher, sometimes lower. On the Great Western broad gauge line, the greater width of the carriages necessarily affords greater accommodation. Perhaps it would not be far out of the way if we were to say that the average capacity of the carriages employed in European countries generally at the present time may be taken at 18 for first class, 32 for second class, and 38 to 40 for third class.[1]

Although the returns made to the Board of Trade specify from year to year the number of passenger vehicles owned by each railway company, they do not separate the several classes. This is unfortunate for the purposes of our inquiry. If we were in a position to divide the number of each description of passengers carried into the number of carriages provided for their use, we should be able, without much more trouble, to place our fingers on the weakest parts of the system of passenger transport. As it is, however, we can only deal with the figures as we find them, and if some of the conclusions founded thereupon should be necessarily more or less hypothetical, they will not be altogether unsupported by more solid foundations.

We now come to compare the results of working the principal railways in Great Britain, from the point of view that we have just been considering. These are set forth in the following table:—

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[1] The earlier mail carriages on the London and Birmingham line only seated twelve passengers. Within the last thirty years, the average weight has been increased from 3¼ to 5½ and even 6 tons, and the capacity from 462 to 1000 feet.

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Statement showing the Number of Carriages Owned by Leading British Railway Companies, the Number of Passengers Carried, and the Gross Receipts per Carriage.

Railways.	Number of Carriages.	Number of Passengers Carried (1=1000).	Gross Receipts from Passengers (£1=1000).	Number of Passengers Carried per Carriage.	Gross Receipts per Carriage.
Great Eastern	2,004	65,633	£1,629	32,751	£813
Great Northern	1,713	24,662	1,256	14,397	733
Great Western	3,050	50,917	2,984	16,694	978
Lancashire and Yorkshire	2,094	40,517	1,341	19,349	640
London and North-Western	4,304	55,876	3,372	12,982	783
London and South-Western	1,783	34,562	1,712	19,384	960
London, Brighton, and South Coast	2,223	39,441	1,462	17,742	658
London, Chatham, and Dover	793	28,276	796	35,657	1,004
Manchester, Sheffield, and Lincoln	659	10,829	390	16,432	592
Midland	2,516	32,358	1,944	12,861	773
North-Eastern	2,066	34,520	1,567	16,709	758
South-Eastern	1,518	25,526	1,279	16,816	843
Caledonian	1,201	17,569	859	14,629	715
Glasgow and South-Western	675	8,152	400	12,077	593
North British	1,366	20,679	862	15,138	631

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These figures show remarkable differences that are not in all cases easily accounted for. In regard to the numbers shown to have travelled for each carriage owned, the variations may be explained by the qualifying circumstances already named; but it may well be asked, Why should one company only earn £593 per carriage, while another runs up to £1004?—Why should the Brighton line show an average of £658, while the Chatham and Dover line, running through a great part of the same district, gets about £350 more? The differences are not to be explained by the differences in fares alone. They may, however, be partly due to the greater proportions of first or third class travel, as the case may be.

One fact that appears to be clearly brought out in the table just referred to is, that short distance travel is the most lucrative to the companies—that is to say, if the experience of the Chatham and Dover line, which has both the highest number of passengers and the largest gross earnings per carriage, may be accepted as worth anything. And this Company's experience appears to be confirmed by that of the Great Eastern, and, to a less extent, by that of the South-Western. On the Metropolitan line the number of passengers carried per vehicle is about 150,000, and the average earnings per passenger carriage is £2600, or about three times that of the great trunk lines. This is even more strongly corroborative of the circumstances we have just stated. The cause of the difference in favour of short journey lines is no doubt that carriages are not run empty, or nearly so, over very long distances, as they are apt to be in the case of the lines that go farther afield.

On the Continent of Europe, a record is kept, not only of the number of carriages owned by each company, but also of the total number of places which they contain, the average in each carriage, the proportion of places provided that have been occupied over the year, and the average number of places per kilometre exploited.

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These interesting *data* we have compiled and collated for the principal European countries in the table that follows. It will be noted that the average number of places provided for each 1000 passengers carried, varies from a minimum of 2.56 in Belgium to a maximum of 8.83 in Roumania. When we further find that Roumania had 32.2 per cent. of the total places provided occupied during the year, while Belgium only had 20.79 per cent., it would appear as if the rolling stock in the former country were kept largely in reserve. The largest average of places per kilometre is provided by Belgium, where also is found the greatest density of passenger traffic:—

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Statement showing the Number of Passenger Carriages in each European Country, with the Total Number of Places, the Average Number of Places for each 1000 Passengers, the Average Number of Places in each Carriage, the average Number Occupied, and the Average Number of Places per Kilometre of Line Open.

Countries.	Number of Passenger Carriages.	Total Number of Places in Passenger Carriages.	Total Passengers (1=1000).	Average Number of Places for each 1000 Passengers.	Average Number of Places in each Carriage.	Average Number Occupied.	Average Number of Places per Kilometre Exploited.
Germany . . .	20,843	898,811	232,563	3·86	43.11	23.66	26.25
Austria . . .	7,607	281,474	47,211	5·96	37.00	24.27	14 66
Belgium . . .	3,386	136,332	53,299	2·56	40.26	20.79	37.09
Denmark . . .	574	24,874	7,307	3·40	43.33	25.76	15.82
France	18,004	734,528	204,758	3·59	40.79	...	25.69
Italy	4,943	183.732	34,271	5·36	37.17	25·73	20.39
Luxembourg . . .	41	1,445	438	3·30	35.24	7·22	10.78
Norway . . .	413	12,535	2,470	5·07	30.35	23·50	9.34
Holland . . .	1,396	60,965	17,151	3·55	43.67	20.80	30.63
Roumania . . .	385	12,390	1,403	8·83	32.18	32.22	8.92
Russia	6,966	260,179	37,210	6·99	37.34	33·90	11.21
Finland . . .	248	7,909	1,813	4·36	31.89	25.25	9.50
Switzerland . . .	1,702	76,207	22,658	3·36	44.77	30.93	26.51
Totals . .	66,508	2,691,381	662,552	4.06	40.47	...	...

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The conditions of Continental passenger traffic may be examined from other standpoints that are calculated to throw more or less light on the subject. One of these is that of the number of kilometres run per axle of passenger carriages; the other, that of the number of passengers carried per axle.

To appreciate these *data*, however, it is necessary that we should understand the average relation of the number of axles to the number of passengers, or the tonnage of goods carried. So far as Continental Europe is concerned, this relation is fairly uniform. There is more variety, perhaps, in the United Kingdom; and in the United States the general adoption of bogey frames makes a comparison of results difficult.

The two following tables, constructed from official records, exhibit the comparative results obtained in different European countries, and on State and private lines in each, with respect to the relation of passengers and goods carried to the number of axles employed:—

Statement showing the Average Number of Kilometres Run per Axle of Passenger and Goods Rolling Stock, on the State and Private Companies' Lines of the Principal European Countries.

Countries.	State Lines.		Companies' Lines.	
	Number of Kilometres per Axle.		Number of Kilometres per Axle.	
	Passenger Cars.	Goods Wagons.	Passenger Cars.	Goods Wagons.
Germany . . .	34,102	15,560	33,341	15,162
Austria	32,436	18,814	32,866	18,101
Belgium	20,285	10,526	28,963	8,743
Denmark . . .	18,904	13,310	33,347	12,842
France	32,741	8,425	48,030	15,853
Italy	37,136	16,414	35,042	15,384
Luxembourg . . .	...	...	65,813	5,696
Norway	24,846	8,827	24,443	8,718
Holland	45,679	15,162	38,529	14,508
Roumania . . .	25,063	9,613	41,652	13,520
Russia	36,168	12,525	44,646	16,484
Switzerland . . .	...	...	21,262	11,127

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Statement showing the Average Number of Passengers, and the Average Number of Tons Carried, per Axle of Passenger Cars and Goods Wagons, respectively, in Continental Countries.

Countries.	Passengers Carried per Axle on		Tons of Goods Carried per Axle on	
	State Lines.	Private Lines.	State Lines.	Private Lines.
Germany . .	4.46	4.72	2.10	2.12
Austria . .	3.26	4.25	2.67	2.26
Belgium . .	4.63	3.99	1.86	2.30
Denmark . .	5.13	5.38	1.11	1.02
France . .	7.04	8.34	2.63	2.24
Italy . .	4.47	5.89	1.68	1.96
Norway . .	3.39	4.36	1.21	1.77
Holland . .	3.32	5.08	1.78	1.53
Roumania .	4.74	4.90	1.78	2.29
Russia . .	4.43	4.17	2.13	2.37

There does not appear to be any sufficient ground in these figures upon which to base an argument either for or against the superiority of Governmental administration of railways. So far as goods traffic is concerned, it appears that in four countries—Germany, France, Roumania, and Russia—the private companies get a greater mileage per axle than the State; but in the other countries the difference is in favour of State-administered lines, although not, in any instance, to a very striking extent. So far, again, as the returns of passenger traffic go, it appears that a larger average mileage has been got by private companies in Austria, Belgium, Denmark, France, Roumania, and Russia, while in the other countries tabulated, the superiority rests with the State.

Attention may also be directed to the remarkable differences that obtain in reference to the mileage returns of different countries, Luxembourg showing a maximum of 65,813, and Denmark a minimum of only 18,904, kilometres, for passenger carriages; while, as regards goods wagons, the maximum is 18,814 in the case of the

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Austrian State lines, and the minimum 5696 in the case of Luxembourg.

In regard to every European country, except England, details are available of the number of places provided in the passenger rolling stock. The average number of places throughout the European Continent is found to be 40 per carriage. If this number is assumed for the United Kingdom, it follows that the 33,031 passenger vehicles in this country at the end of 1884 would afford places for 1.321,240, being an average of rather under two places for each 1000 passengers carried. In the case of the United States, the *data* as to places is equally defective. But if the European average is again assumed, it would appear to follow that the 17,899 passenger cars in that country provide accommodation for 715,960 seats, and that there would thus be about 2.3 places for each 1000 passengers carried.

The fact appears, therefore, to be, that in the United Kingdom the number of places provided relatively to the numbers carried is lower than in any Continental country or the United States, but this is assuming, of course, that the *average* accommodation per car is in all cases approximately alike.

It is not unusual to bring the number of passenger vehicles, and of rolling stock generally, to the standard of the mileage open. In England and Wales the number of carriages provided per mile of line has increased from 1.82 to 2.09; in Scotland, from 1.16 to 1.23; and in Ireland, from .55 to .57, as between 1874 and 1884. In the United States, the mileage open in 1884 was 120,551 miles, and the number of passenger vehicles was 17,899, so that the average per mile was only 0.14. This last figure is lower than that found for any European country, as the statistics contained in the next table will make manifest:—

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Statement showing the Numbers of Locomotives, Passenger Carriages, and Goods Wagons per Mile of Line Open in Different European Countries in 1883.

Countries.	Miles Open.	Number of Locomotives.	Number per Mile.	Number of Passenger Vehicles.	Number per Mile.	Number of Goods Wagons.	Number per Mile.
Germany	21,910	11,330	0.52	20,843	0.95	235,708	10.76
Austria-Hungary	12,151	3,671	0.30	7,607	0.63	85,785	7.06
Belgium	2,090	1,790	0.86	3,386	1.62	50,164	24.00
Denmark	1,005	...	...	574	0.57	2,913	2.90
France	17,684	8,088	0.46	18,004	1.02	222,232	12.57
Italy	5,693	...	...	4,943	0.87	28,643	5.03
Luxembourg	92	34	0.37	41	0.45	812	8.83
Norway	822	111	0.14	413	0.50	2,550	3.10
Holland	1,132	519	0.46	1,396	1.23	7,584	6.70
Roumania	861	211	0.25	385	0.45	4,943	5.74
Russia	14,478	5,844	0.40	6,966	0.48	115,699	7.99
Finland	516	98	0.19	248	0.48	2,177	4.22
Switzerland	1,673	595	0.36	1,702	1.02	8,720	5.21
Totals and averages	80,107	32,591	...	71,508	0.89	767,930	9.5

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This table shows that the greatest number of passenger vehicles, relatively to the mileage open, is found in Belgium, where it is 1.62, being almost double the proportion found for Germany, and more than double that found for Austria-Hungary. Belgium has also the largest number of locomotives and goods wagons per mile of line. The proportion of passenger vehicles per mile of line open is, however, 24 per cent. higher in England than in Belgium. With a total of 33,031 passenger vehicles, the United Kingdom possesses 31 per cent. of the total rolling stock of this description in European countries as a whole. There is, however, as we shall presently see, a great difference in the relation of the different classes of vehicles employed on British railways to the numbers carried and the profits earned.

In the United States, where the passenger traffic is much less dense than in the United Kingdom, the average number of passenger carriages in 1883 was 6 per mile operated, 10 per 1000 train miles, and 18 per 1000 passengers carried. The proportions, however, varied very much as between the different groups of States. In the New England States, the number of carriages per 1000 passengers carried rose to 31. In the Southern States, the proportion fell to 9. The Middle States showed an average of 20, and the Southern States an average of 13. The following tabular statement shows the details for each group of States :—

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Statement showing the Number of Passenger Vehicles in the United States relatively to the Mileage of Line actually Worked, the Number of Passengers Carried, and the Number of Train Miles Run in 1883 and 1882.

Groups of States.	Number of Passenger Cars.	Length of Line Operated.[1]	Passenger Train Service (1=1000).	Passengers Carried (1=1000).	Passengers Carried One Mile (1=1000).	Number of Passenger Cars.		
						Per Mile Operated.	Per 1000 Train Miles.	Per 1000 Passengers Carried.
New England . .	2,328	6,203	20,006	72,378	1,187,719	3	9	31
Middle . . .	6,403	15,974	54,986	126,736	2,489,766	3	9	20
Southern . . .	1,544	15,589	18,987	14,088	613,891	10	12	9
Western . . .	6,920	63,897	88,743	87,615	3,834,082	9	13	13
Pacific . . .	704	5,274	5,180	11,871	415,849	7	7	17
United States . .	17,899	106,938	187,903	315,686	8,154,309	6	10	18
Do. in 1882 . .	15,551	95,752	165,438	289,031	7,483,060	6	11	19

[1] This is not identical with the mileage constructed in the same years. Poor's Manual returns 120,551 miles as built, and only 106,938 miles as operated.

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First-Class Traffic Returns.—It has now almost become an axiom with railway authorities that first-class passenger traffic, if it pays at all (which many affect to disbelieve), does not yield anything like the same profitable return as third-class travel. This problem is, however, involved in some obscurity, from which the most laborious and skilful attempts of economists and experts have not been able wholly to disentangle it.

There are several points of view from which this complex and difficult question may be approached. The more prominent and obvious are:—

The numbers carried relatively to the number of vehicles employed.

The average gross earnings per vehicle.

The first cost of the different classes of vehicles.

The facilities and accommodation provided for different classes of travellers.

The rates of speed employed.

But in order to understand how far each class of travel contributes to the gross result yielded by passenger traffic, it is necessary to possess details of the numbers of vehicles of each class. These details are not recorded in the annual reports of the Board of Trade, but they are to be found in the half-yearly reports of the different companies, and by dividing the numbers of first and third class vehicles employed into the numbers of passengers of each class carried, and the gross earnings therefrom, we find that the first-class vehicles do not yield anything like so good results as the more humble class.[1]

But even if it were otherwise—even if the average result obtained from first-class vehicles was greatly superior to that obtained from third-class, it must not be forgotten that the cost of working first-class traffic is much greater.

Mr. Price-Williams has calculated the expenses of working first-class traffic at 73.2 per cent. of the gross

[1] This subject is further dealt with in the chapter on "English Railway Administration."

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receipts, as compared with 49.8 per cent. of gross receipts expended in working third-class traffic. It is, however, likely to be higher even than this. There are some elements in the working of first-class traffic that are so subtle and complex as to elude even the keenest observation. No one, for example, can say exactly how far express trains are run for the special benefit of first-class travellers. On most of the great trunk lines, third-class passengers may now travel at express speed, equally with travellers of the first class. But on many minor lines, and by certain trains on nearly all of the great trunk lines, this is not yet entirely the case. In so far, therefore, as the element of speed affects the cost of working, first-class traffic must be debited with a much heavier item than third-class.[1] The effect of speed upon the cost of working may be illustrated by the fact that an average passenger train, weighing 134 tons, and travelling at an average speed of 45 miles an hour, will do as much injury to a railway as a coal train, weighing 400 tons, and travelling at an average speed of only 15 miles an hour.

Mr. Price-Williams has analysed the first, second, and third-class traffic receipts and working expenses of the London and North-Western Railway Company, with the following results :—

Description.	Gross Receipts (£1 = 1000).	Working Expenses (£1 = 1000).	Net Receipts (£1 = 1000).
First class . . .	£1,322	£968	£354
Third class . . .	1,708	850	857
Total passenger traffic.	3,030	1,818	1,211

From these figures he has calculated that in the case of first-class traffic the net receipts are only 26.8 per cent. of the gross, whereas in the case of third-class traffic they are 50.2 per cent.

[1] As examples, it may be stated that there are seven express trains daily from Brighton to London to which no third-class carriages are attached. There are also four such trains daily between Dover and London, two between Paddington and Exeter, and many similar cases might be cited.

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Apportioning the working expenses to the different classes of traffic in the ratio of the number of carriages of each class, Mr. Price-Williams has shown, by an analysis of the passenger traffic of the London and North-Western Railway Company, that the net receipts *per train mile* were :—

From first and second class traffic . . .	5¾d.
„ third class traffic . . .	1s. 2¼d.

—while the net receipts per passenger were :—

From first and second class	9¼d.
„ third class	6d.

The *data* upon which these figures are founded would not be accepted as sufficiently conclusive by some authorities. Under any circumstances, however, it is clear that the much fuller train-loads usually got with third-class passengers, and the much less expensive character of the accommodation provided for them, should exercise a powerful influence in the direction to which the calculations of Mr. Price-Williams point.

With the cost of conveying traffic generally the question of tare has very much to do. In the case of the United States, the great reduction of the cost of transport that has occurred within recent years—a reduction that has induced great surprise, and even incredulity, in many minds in England—has been largely attributable to the reduction of tare relatively to the paying weight carried. There are, however, very few railway accounts that show the incidence of this factor, although it is to be presumed that it is not unknown to the gentlemen whose special business it is to control goods traffic. The railway accounts for New South Wales are an exception to the general rule. They show the exact proportions of paying and non-paying traffic, in the following form :—

	d.
Average receipts per ton per mile for coaching traffic .	15.44
Do. do., including tare . .	0.58
Average receipts per ton per mile for goods traffic . .	1.90
Do. do., including tare . .	0.41

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It would be interesting and valuable if the railway accounts of European countries were kept in such a manner as to bring out these results in the same form.

There are several circumstances peculiar to English railways that should be considered in relation to the question of passenger traffic economy. One of these is the average rate of speed at which passenger trains are worked. Another is the number of trains provided to meet the traffic requirements. It is very well known that, as a general rule, the average speed of express trains, and the number of such trains provided between the principal centres of population in the United Kingdom, are much greater than in any other country in the world. Railway managers profess that these are desiderata that the British public imperatively demand, and for this argument they have ample reason. But if Englishmen will insist upon travelling at the rate of fifty miles an hour, and having more express trains than any other country, they must expect to have to pay somewhat more for the costly facilities thus provided.

In reference to this subject the Royal Commission of 1867 pertinently observed:—

"There are many duplicate trains run by competing lines at the present time which, by agreement between the Companies, might be avoided. Thus the Great Western and the London and North-Western Railway Companies run trains to Birmingham, which start nearly at the same time. The South-Eastern and the London, Chatham, and Dover Railway Companies run trains between London and Dover which start together and arrive at the same time. So do the North-Western and the Great-Northern, between London and Manchester. In many of these cases one train would suffice to carry all the passengers.

"It must, however, be borne in mind that in each of these cases, and probably in every case of competing lines, the second line between the places supplies accommodation to an intermediate district which would be unprovided

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with accommodation without it; and that, if the through traffic is to be accommodated by means of fewer trains, it would be necessary that the return tickets of one line should be available by the other line; that is to say, that the receipts must be divided. There is no doubt that this is the tendency of the railway management at the present time. It is quite certain that competition has produced economy of railway management, and that it has led to the rapid improvements in engines and permanent way which have taken place; and, however desirable greater economy in the administration of railways may be, the present system depends so entirely upon the feelings and wishes of society, and on the desire of the railway companies to comply with those wishes, that we do not think that any advantage would result from the interference of authority in this matter. But one means by which any undue extravagance of railway companies or defects in the administration may be made apparent to the shareholders and the public, and thus stimulate economy, would be by a judicious comparison of the receipts and expenditure on one line with the receipts and expenditure upon other lines. Such a comparison can only be obtained by the several railway companies rendering their accounts to the Board of Trade on a uniform plan."

These weighty remarks are, in the main, quite as true now as when they were written twenty years ago, and they really contain the pith of the whole matter.

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CHAPTER XIX.

GOODS TRAFFIC.

If there is any one feature of the goods traffic of our modern railway system that is paramount in its claims upon the attention of mankind, and absorbing in the interest which it is entitled to excite, it is the undoubted fact that it is the largest and most important business that has ever been carried on in the annals of the world. From this generalisation, agriculture may no doubt, in certain respects, demand to be excepted; but as regards the great volume of materials dealt with, railway transport leaves even the business of husbandry far behind. Every other industry must "pale its ineffectual fires" before the gigantic operations of that system to which all are tributary and subordinate. The mineral industries are, as regards volume, of the utmost importance, but they are entirely overshadowed by the transport returns, in which they figure so conspicuously in all the leading countries of the world.

We propose in this chapter to consider briefly how this great business of goods and mineral transportation is carried on, and the conditions of its development.

To what test shall we bring, and how shall we adequately describe, the enormous magnitude of this carrying trade? If we deal with weight alone, we find that on the railways of Europe and the United States, collectively, the total volume of goods traffic carried in 1882[1] amounted to over

[1] This year has been adopted, because there are no later returns for some countries, and it seemed desirable to select a period that would apply to all countries alike.

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a thousand million tons.[1] The total gross receipts from this traffic over the same geographical area amounted to 232½ millions sterling, of which the United Kingdom took 16.7 per cent., the United States 36 per cent., and Germany about 14 per cent., these three countries being the largest contributors to the total.

The imagination almost recoils from any attempt to grasp the relative proportions and importance of these figures. The total tonnage of minerals raised in the United Kingdom—the greatest mineral-producing nation in the world—is about 180 millions a year. The railways of Europe and the United States carry more than six times this volume of traffic. The total agricultural income from land in the United Kingdom is now calculated at about 50 millions sterling. The income of European and American railways, in respect of the transport of goods traffic, is nearly five times that amount. Try it by what standard we may, and we shall find that the business carried on by the railways of the world is unique in its magnitude, its width of range, and its influence on the destinies of nations.

And yet this huge development is only of comparatively recent origin. It is less than fifty years since the first railway that was established on a scale of any importance was opened for public traffic. Previous to that period the inland transport of goods and merchandise of every kind was effected either by canals, by pack-horses, or by wagons. But the absence of canal navigation in many important districts imposed upon them the necessity of employing horse-power alone.

Dr. Lardner states that "a horse of average force, working for eight or ten hours a day, cannot transport on his back more than two hundredweight, and that he can carry this at the rate of only twenty-five miles a day over an average level country." Now, the total number of tons carried one mile in Continental Europe and the United States in 1882 was 60,815 millions. If we assume the average

[1] Exactly 1,001,766,000.

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length of lead in the United Kingdom to be thirty miles, the total number of tons carried one mile in this country would be 7991½ millions more. This gives us a total of 68,806½ million tons carried one mile for Europe and the United States. To have conveyed this ton-mile traffic by horse-power would, therefore, have required the services of not less than 30 million horses, assuming each horse to work to his utmost capacity for 314 days out of the 365.

In the United Kingdom, the goods traffic is divided, in the returns made by the railway companies to the Board of Trade, into the three several branches of—

1. General merchandise.
2. Minerals.
3. Cattle.

In the United States, even this imperfect and halting attempt at a division of traffic is not attempted, except in the Census Reports; and as these are only drawn up once in ten years, and generally published two or three years subsequent to the date to which the figures apply, they are not of much practical value.

On the Continent of Europe, the classification of goods traffic generally adopted is—

1. Luggage (baggage).
2. Merchandise by quick trains (*grande vitesse*).
3. Merchandise by slow trains (*petite vitesse*).
4. Cattle.

Each of these divisions of traffic leaves much to be desired. There would seem to be no insuperable obstacle in the way of adopting the United States Census classification, which provides for the quantities of each of thirteen different varieties of goods being separately distinguished, the more important being grain, cotton, live-stock, provisions, timber, coal, petroleum, iron, and manufactures. As regards the United Kingdom, the returns for the year 1883—when the *maxima* were attained—were as follows:—

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Statement showing the Tonnage of Goods and Minerals Carried on the Railways of the United Kingdom in 1883.

Countries.	Minerals (1 ton = 1000).	Merchandise (1 ton = 1000).	Total (1 ton = 1000).
England . .	160,522	65,387	225,909
Scotland . .	27,767	8,692	36,459
Ireland . .	1,196	2,817	4,013
Totals .	189,485	76,896	266,381

The total tonnage moved upon the railways of the United Kingdom in 1883 was just 24,516 tons less than the total tonnage moved upon the railways of the United States for the Census year 1880. But, while the total receipts from freight traffic in the latter year were £83,229,000, or an average of 5.7s. per ton, the total gross revenue from the goods traffic of the United Kingdom was only £38,675,900, or an average of 2.9s. per ton—a difference that is obviously accounted for by the much greater length of lead in the United States, which, as elsewhere shown, has been calculated for the whole of that country at an average of 111 miles, as compared with an average of probably less than a third of that distance in the United Kingdom.

The goods traffic of the United Kingdom is distinguished by several features that are peculiar to itself, the more important and characteristic being—

(1.) That the tonnage carried per mile of line open is larger than in any other country.

(2.) That the gross receipts per mile open is greater than in any other country.

(3.) That the proportion of minerals carried, relatively to the total tonnage, is also exceptionally high.

(4.) That the average distance over which the traffic is carried is shorter than in most other countries.

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Each of these distinguishing features is of greater or less effect in determining the conditions under which the traffic is worked, and ought to influence, if it does not, the rates at which it is carried.

The incidence of the goods traffic, in relation to the open mileage of each leading European country and the United States, is set forth in the following tabular statement:—

Statement showing the Tonnage of Goods Traffic Carried on the Railways of Different Countries, and the Average per Mile Open.

Countries.	Tons of Goods Traffic Carried (1=1000).	Miles Open.	Average Tons Carried per Mile Open.
Germany	183,808	21,785	8,447
Austria-Hungary	64,754	12,603	5,138
Belgium	27,640	1,885	14,132
Denmark	1,148	926	1,240
France	96,822	16,578	5,840
Italy	11,598	5,871	1,975
Norway	1,050	970	1,082
Holland	5,939	1,406	4,224
Roumania	1,396	899	1,553
Russia	44,067	14,226	3,098
Switzerland	6,366	1,795	3,547
Totals and average	444,588	78,944	5,632
United States	400,453	120,551	3,321
United Kingdom	266,381	18,530	14,376

It is not pretended that, because the average tonnage carried per mile of line open is higher in the United Kingdom, the cost of working the traffic should be correspondingly low, and the average net receipts correspondingly high. All other things being equal, the cost of working should certainly be diminished as the traffic is increased, because that cost is then spread over a larger gross income. But the circumstances of English

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railways are so far exceptional that this rule is not so strictly applicable in the United Kingdom as it would be in some other countries. This has been more fully explained in dealing with the cost of construction and working. At the same time, it is a perfectly fair argument to use against English railways, that, as they have unique advantages in regard to the comparative extent of their traffic, they ought to be able to grant unique facilities for its development, and may reasonably be expected to concede lower rates than countries that have not one-third or one-fourth the traffic for a given mileage. We shall see by-and-by, however, that the mileage test, although the most convenient, is not the only, nor indeed the best, one to apply to the determination of this problem.

The next point of view from which we propose to attack the question of goods traffic is that of the receipts derived therefrom. This is a matter that may be approached in either of two ways. It may be considered, as we have already seen, in reference to the average gross receipts per mile of line constructed, or it may be dealt with in respect to the average gross receipts per train mile. There is no necessary correlation between the two standards of comparison. On the contrary, as we shall presently see, the one average may be very high, while the other is exceptionally low.

Taking, again, the year 1883, as being the year of maximum results,[1] we find that the gross receipts from goods traffic of all kinds in the United Kingdom then amounted to 38¾ millions sterling, being an average of £2072 per mile. The countries that come next to this average in Continental Europe are—

[1] It may be argued, of course, that it would be better to take an average of years, or the latest year for which returns are available; but it would hardly be fair to adopt a year during which trade was so exceptionally depressed as in 1884 and 1885, and up to 1883 the progress of railway traffic had been almost steadily upward.

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Belgium, with £1936 per mile.
Russia, „ 1848 „ „
France, „ 1824 „ „

The receipts earned per mile of railway constructed in each European country and in the United States, respectively, are shown in the following statement:—

Mileage of Railways Constructed in Different Countries, with Total Amount of Goods Traffic, and Total and Average Receipts therefrom, per Mile of Line.

Countries	Miles Open.	Tons Carried (1 = 1000).	Total Gross Receipts from Goods Traffic (1 = 1000£)	Average Receipts per Mile.
Germany . . .	21,785	183,808	£32,914	£1,511
Belgium . . .	1,885	27,641	3,649	1,936
France	16,578	96,822	30,236	1,824
Switzerland . . .	1,795	6,366	1,447	806
Italy	5,871	11,598	4,325	737
Austria	12,603	64,755	18,249	1,448
Holland	1,406	5,939	913	649
Denmark . . .	926	1,148	263	284
Norway	970	674	183	189
Russia	14,226	44,068	26,295	1,848
United States (1880) .	87,762	290,897	83,229	948
Totals and average .	165,807	733,716	£201,703	£1,216
United Kingdom . .	18,530	266,381	37,670	2,033

Although, as we have seen, the average receipts from goods traffic, per mile of line open, are higher in the United Kingdom than in any other country, the case is quite different when we come to deal with the average receipts per train mile. It turns out, indeed, that, with the exceptions of Luxembourg and Holland, the average receipts per train mile are less in the United Kingdom than in any other European country, and considerably under those of the United States. The following table shows the details:—

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Statement showing the Mileage of Goods Trains in Different Countries, and the Total and Average Receipts per Train Mile derived therefrom.

Countries.	Mileage of Goods Trains (1=1000).	Gross Receipts from Goods Traffic (1=1000).	Average per Train Mile.
		£	s.
Germany . . .	70,579	32,914	9.3
Austria . . .	29,713	18,249	12.3
Belgium . . .	11,867	3,649	6.1
France	55,734	30,236	10.9
Italy	10,724	4,325	8.1
Luxembourg . .	433	91	4.2
Holland . . .	1,400	912	13.0
Russia	43,860	26,295	12.0
Finland . . .	531	187	7.0
United States . .	251,052	111,101	8.9
United Kingdom . .	126,672	37,670	5.9
Totals and average .	602,565	265,629	8.8

To account for the differences that distinguish different countries, in reference to their train-mile receipts, is one of the most thorny problems in railway economy. The question is affected by many different considerations, but primarily and mainly by the character of the traffic carried, and by the average weight of the train. The receipts per train mile would naturally be expected to take a lower range in countries like the United Kingdom and the United States, where the greater bulk of the traffic is of a character that is regular and easily handled, such as minerals, lumber, grain, &c. But even this does not explain everything. It is a well-established fact, that in the United States the average ton-mile rates are much under those of the United Kingdom; and after a very liberal allowance has been made for an increased weight in the load hauled, it still remains a problem how the average receipts per train mile in the United States come to be 37 per cent. higher than the average of the United Kingdom. The mystery is intensified when we

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come to examine the average ton-mile rates of the different countries, as shown in the next table:—

Statement showing the Total and Average Receipts from the Working of Goods Traffic in Different European Countries in 1883.

Countries.	Number of Tons Carried (1=1000).	Number of Tons Carried One Mile (1=1000).	Goods Traffic, Gross Receipts (£1=1000)	Goods Traffic, Average Receipts per Ton.	Average Receipts per Ton per Mile.
			£	s.	d.
Germany . .	183,808	9,312,479	32,914	3.58	0.85
Austria . .	64,755	4,182,151	18,249	5.64	1.05
Belgium . .	27,641	1,131,393	3,649	2.64	0.77
Denmark . .	1,148	45,680	263	4.58	1.38
France. . .	96,822	6,780,802	30,236	6.25	1.07
Italy . . .	11,598	864,748	4,325	7.46	1.20
Luxembourg .	1,925	22,696	91	0.95	0.96
Norway . .	674	29,279	183	5.43	1.50
Holland . .	5,939	287,575	913	3.07	0.76
Roumania . .	1,397	103,738	572	8.19	1.32
Russia . .	44,068	5,449,089	26,295	11.93	1.16
Finland . .	646	42,706	187	5.80	0.99
Switzerland .	6,366	214,057	1,447	4.55	1.63
Totals and averages	446,787	28,466,593	119,324	5.34	1.01

Now, it is a fair presumption that the average receipts per train mile from goods traffic should be lowest where the average ton-mile rates were lowest, and highest where they were highest. This would undoubtedly be the case *if all other things were equal.* But as all other things are not equal, we find, among other apparently irreconcilable facts, that Austria-Hungary, which has a lower average ton-mile rate than France, has a considerably higher train-mile revenue, and that Germany has a higher train-mile revenue than Italy, although the ton-mile rate of the latter is about 40 per cent. higher. The explanation of these apparent anomalies will be found to lie partially in the fact that in some countries the ratio of empty

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to loaded trains is much larger than in others. In England and Wales, for example, it may be assumed that the trains carrying mineral traffic almost always return entirely empty, whereas ordinary goods trains can often make up a return load.

The average receipts from goods traffic per ton carried are also set out in the foregoing table. This is a function of the ton-mile rate and the average length of lead, but more particularly of the latter. Russia, which has the longest average length of lead, has also, as might be expected, the largest average revenue per ton moved.

The average length of lead, on the State and private lines, respectively, of the leading Continental countries in 1883 is shown in kilometres in the following table:—

Statement showing the Average Distance over which Goods Traffic was Carried in the Principal Countries of Continental Europe in 1883.

Countries.	Average Length of Lead on				Average of all Lines.
	State Lines.	Private Lines Worked by State.	Private Companies' Lines.	State Lines Worked by Private Companies.	
Germany . .	82.63	89.50	69.96	...	81.74
Austria-Hungary	137.54	108.71	100.49	46.92	81.10
Belgium . .	71.80	...	43.43	...	66.01
Denmark . .	76.80	...	50.06	...	64.18
France—					
Lines of general interest	70.05	...	119.96	33.41	116.75
Lines of local interest	...	...	20.49	...	...
Italy . . .	125.67	...	120.25	...	...
Holland . .	...	...	88.33	72.00	78.09
Russia . .	195.31	...	213.92	...	213.42

These figures show that the shortest average lead on the Continent coincides with the highest average ton-mile rates, both being characteristic of the local lines of France, on which the average ton-mile rate is more than double

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that of Germany and Belgium. It does not, however, appear that the longest lead is coincident with the lowest ton-mile rates, since Russia shows the former and Holland the latter. There is, in fact, no evidence of any uniform relation of rates to distances, even in the same countries, although this is the broad general principle upon which railway managers generally profess, all other things being equal, to conduct their affairs.

It has been stated that one of the most striking differences that distinguish English from other railway systems, in the matter of goods traffic, is that of the greater proportion of minerals carried. The total quantity of minerals carried on English railways in 1883 was 189½ millions of tons, being 71 per cent. of all the goods traffic carried. In the United States, in 1880, the total quantity of mineral traffic carried, including in this term not only minerals proper, but lime, cement, iron, and steel, amounted to 109 millions of tons, or 34 per cent. of the total.[1] The ratio of mineral to aggregate goods traffic in England was, therefore, double that found for the United States.

At the same time, it is to be observed that in Great Britain, as in other countries, there are wide differences as between one company and another, in respect of the relative proportions of goods and mineral traffic which they severally carry. These differences may be appreciated by a glance at the following table:—

[1] The quantities of mineral traffic carried on the railways of the United States in subsequent years are not available, so that we cannot make a reliable comparison for a later year than 1880.

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Statement showing the Tonnage of Merchandise and Minerals Carried upon the Fifteen Leading British Railways in 1883.

Railways.	Tons of Minerals Carried (1=1000).	Tons of General Merchandise Carried (1=1000).	Total Tons Carried (1=1000).	Percentage of Minerals on Total Tonnage Carried.
1. London and North-Western .	27,101	8,652	35,753	75
2. Great Western . . .	18,904	5,341	24,245	79
3. Great Northern . . .	4,736	4,692	9,428	56
4. Lancashire and Yorkshire .	10,405	4,812	15,217	67
5. Midland	15,431	10,009	25,440	60
6. North-Eastern . . .	30,782	8,977	39,759	77
7. Manchester, Sheffield, and Lincoln . .	6,411	4,463	10,874	55
8. Great Eastern . . .	2,912	4,239	7,151	41
9. London and South-Western .	2,083	1,568	3,651	57
10. North British	10,297	3,291	13,588	71
11. Caledonian	11,986	3,218	15,204	80
12. Glasgow and South-Western .	4,100	1,035	5,135	80
13. London, Brighton, and South Coast	1,654	890	2,544	65
14. London, Chatham, and Dover	1,469	708	2,177	67
15. Taff Vale	8,986	435	9,421	95
Totals . .	157,257	62,330	219,587	72

The maximum ratio of mineral to total goods traffic shown in this table appears in the case of the Taff Vale Company, while the two next highest are the Caledonian and the Glasgow and South-Western. The greatest absolute quantity of minerals was carried by the North-Eastern. The lowest proportion of mineral to other traffic appears in the case of the Great Eastern.

There is another interesting aspect of this subject to which we may here direct attention. In some countries the larger proportion of the gross traffic receipts is derived from passenger traffic. In the United Kingdom, and more especially in England and Wales, the chief contributor to the gross revenue is the goods traffic. Of 71 millions sterling of gross receipts earned by the railways of the United Kingdom from all sources in 1883, 38¼ millions,

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or about 55 per cent., was derived from goods traffic. The following statement shows how this result compares with that brought out for other countries on the Continent of Europe and for the United States:—

Statement showing the Gross Receipts from Goods and Passenger Traffic, respectively, in Different Countries.

Countries.	Total Gross Receipts (£1 = 1000).	Of which there were Received		Percentage of Total Received from Goods Traffic.
		From Goods Traffic (£1 = 1000).	From Passenger Traffic.	
Germany . . .	£46,191	£32,914	£13,277	71
Austria	23,594	18,249	5,345	77
Belgium . . .	5,476	3,649	1,827	65
Denmark . . .	654	263	391	40
France	44,638	30,236	14,402	68
Italy	7,736	4,325	3,411	56
Luxembourg . . .	104	91	13	88
Norway . . .	2,044	183	1,861	9
Roumania . . .	925	572	353	62
Russia	34,426	26,295	8,131	76
Finland . . .	317	187	130	59
Switzerland . . .	2,683	1,447	1,236	54
Totals and average .	£168,788	£118,411	£50,377	70

Nine European countries out of the twelve tabulated appear to have a higher percentage proportion of revenue from goods traffic than the United Kingdom. In the case of the United States, the preponderance of goods traffic receipts is almost equally marked, since 67 per cent. of the total gross railway income of 1883 was derived from that source.[1]

[1] The total revenue of all the railways of the United States from all sources was 807 millions of dollars, of which 544½ millions were derived from freight.

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CHAPTER XX.

RAILWAY TRANSPORTATION CHARGES.

"It may be said, that, as Parliament has established limits to the tariff of railway traffic, so long as the companies keep within these, they should be subject to no interference. To this, however, it can be answered, that when those limits were fixed, the Legislature had no sufficient *data* by which an equitable amount could be established. Can it for a moment be maintained that if, by new inventions, railways could be constructed by the expenditure of half the capital sunk on those now open, and worked at half the present expense, the public would not have a right to demand a proportionate reduction in the carrying tariff?"[1]

It is the aim of the trader and railway traveller, in regard to locomotion, as in reference to transactions that are deemed to come more strictly within the scope of commerce, to "buy in the cheapest market," and it appears to be equally the object and end of British railways to "sell in the dearest market," the services which they are called upon to render to the public.

This condition of affairs necessarily places the railways, as a system, and the public, in an attitude of constant antagonism to each other. It is no doubt true that, up to a certain point, their interests are largely identical—that is to say, it is the interest of the railway companies to stimulate traffic in every possible way, and to afford such

[1] *Edinburgh Review*, October 1846.

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rates as will bring on to their lines the maximum of remunerative business, while the interest of the traders lies in securing the lowest possible range of rates and fares, by enabling such charges to be distributed over as wide an area of business as possible.

But there is, after all, another and a more obvious relationship between the two interests, which is not one of such strict harmony and identity. The trader is interested in obtaining as low a range of rates as possible, quite independently of the conditions under which the railways require to operate. The railway companies, on the other hand, make no secret of the fact that, in cases where there is little or no competition compelling a different course, their guiding principle is that of imposing on the traffic just as much as it will bear.

The enormous powers possessed by railway corporations, and their great and manifest liability to abuse, have led to restrictions being imposed on their rates and fares in almost every country in the world. These limitations, in the case of British lines, are expressly set forth in the various Acts of Parliament under which they have been authorised, and by which they are controlled.

Traders, however, are not, and can hardly, perhaps, be expected to be, satisfied with these limitations. In many cases they claim that the *maxima* are too high; in others, that they are habitually exceeded; in others, again, that undue preferences are accorded to individual traders or districts. Now, we hear that terminal charges are imposed, which were neither contemplated nor provided for when the maximum rates were fixed; and then, again, that the system under which rates are levied enables foreigners to compete successfully with home agriculturists and manufacturers.

It is impossible that the infinitely varied and complex aspects of this most difficult question can be adequately considered in the course of a single chapter. The railway problem, however, would be very imperfectly presented

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without some endeavour being made to set forth the conditions under which the reciprocal relations of railways and the public are regulated in this regard.

The Royal Commission of 1867 remarked, with reference to the clauses governing tolls and charges, that "there is not only a diversity in the amount of tolls for the use of the line, and in the rates, when the company is a carrier, but an imperfect enumeration, and often a diversity of classification, of the various goods to which the tolls apply. Thus, some important commodities are altogether omitted, and the class in which a particular article is placed in the Act of one company is not always the same as that in which the same article is placed in the Act of another company. In some cases, Parliament has taken advantage of the amalgamation of companies to bring all their powers as to rates and tolls into the Amalgamation Act; this has been done, for instance, in the case of the Lancashire and Yorkshire Railway, and to some extent in the case of the London and North-Western Railway, whilst in other cases the toll clauses are scattered through the numerous separate Acts originally obtained by the companies which have since been amalgamated."

As an example, it is stated that the Midland Railway Company has its power of levying tolls divided over three Acts. In one Act coals are classed in the lowest class, with a maximum toll of 1d. per ton per mile; in another Act they are classed in the second class, with a toll of 1½d. In one Act grain is classed in the lowest class but one, with a toll of 1½d.; in the other two Acts, it is placed in the next class but one, with a maximum toll of 2d.

In the Midland Railway Acts generally there are four classes for merchandise and minerals; in the Lancashire and Yorkshire there would appear to be eight, in the North-Eastern five, and in the London and South-Western three.

The London and North-Western Railway Company appear to derive their powers from five Acts, in some of

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which the articles are placed in eight classes, in others in three or four classes.

The Great Eastern Railway Company has five Acts, in some of which the articles are placed in five classes, in others in four classes.

The Great Western has thirteen Acts with toll and rate clauses. In one Act, the maximum toll for iron ore and pig iron is ½d. per ton per mile, and in another it is 1½d. In one Act grain is placed in the lowest class but one, with a maximum toll of 1d.; in another Act it is placed in a higher class, with a maximum of 2d.; and in a third Act the maximum toll is 2¾d. In one Act the articles are divided into eight or nine classes, in others into four. One Act enumerates twenty-two articles, another ninety-eight, and another 160.

There is no need to go further, in the way of showing the confused and anomalous condition of the laws under which British railways levy their rates and fares at the present time. That system is, indeed, from first to last, a tissue of absurdities, inequalities, and contradictions. The majority of the Acts under which rates and fares are levied in this year of grace eighteen hundred and eighty-six were passed when the business of transport was much less understood than it is at present; when many errors that have since been exploded by experience were firmly believed in; when tariffs were based on an infinitely smaller volume of business; and when the relation of working expenses to net receipts was entirely different to what it has now, in most countries, become.

Notwithstanding these considerations, however, English railways practically work upon the same tariffs to-day as they did in the infancy of the system. In almost every other country, law, custom, or necessity have compelled railway authorities to adjust their rates to the altered condition of affairs. In the United States, as we have elsewhere shown, the average rates charged for goods traffic are not now more than one-half what they were fifteen years ago.

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In Germany, Belgium, and France, like changes have occurred. England alone refuses to adapt her railway rates to the new *régime*. British railways alone seem unable or unwilling to realise that "the old order changeth, yielding place to new." As a result, English rates and fares are higher than those of most Continental countries, and very much above the average of the United States, at any rate for distances exceeding fifty miles.[1] Naturally enough, traders are wont to be discontented, as well as prejudiced, by this state of affairs. Not less unsatisfactory is the differences that distinguish English and Continental rates in the matter of system or method of arrangement. In England, "no general principle or system for fixing rates has been adopted on any railway."[2] In most Continental countries, on the contrary, the amount of each rate is a known quantity, as well as the terminal charge, if any; so that there is no difficulty in ascertaining how much the transport of a particular commodity, for a particular distance, is likely to cost. Again, *maxima* are provided for on practically all Continental lines, whereas in England there are large tracts of railway over which no maximum rates have ever been fixed. But, most strange and mysterious fact of all, the managers of English lines profess that they "cannot determine with accuracy the cost of conveying any particular kind of goods between two stations," whereas in the United States, and some other countries, this is exactly known.

There is one point that is often made much of in discussions of the average cost at which freight or passengers can be transported—that, namely, of the length of lead. In some countries, the information required in reference to this point is readily available. In the United States,

[1] This is set forth in considerable detail in several recent publications, and notably, as regards Continental countries, in Sir B. Samuelson's "Report on the Railway Tariffs of Germany, Belgium, and Holland."

[2] "Report from the Select Committee on Railways (Rates and Fares), 1882," p. viii.

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the average length of lead for freight tonnage varies from a minimum of 34.6 miles in the States of Louisiana, Arkansas, and Indian Territory, to a maximum of 166.9 miles in the States of Dakota, Nebraska, Kansas, California, Nevada, Oregon, and Washington. But in the former group, the proportion of the total ton-mile traffic of the United States in 1880 was only .08 per cent., while in the latter it was not more than 6 per cent. In the Central and Northern States, including New York, Pennsylvania, Ohio, Michigan, Indiana, and Maryland, which contributed 20,416 millions towards the total of 32,348 millions of tons moved one mile in the year named—being over 60 per cent. of the whole—the average length of lead was 106.1 miles, and this figure may properly be regarded as a fair average of the country generally.

On the Continent, the average length of lead is less than in the United States, but greater than that of British railways. In Belgium and Holland, the distances traversed are, however, generally quite as short as in England, although the rates and fares are considerably lower.

Inequality of Rates and Fares.

The most material complaint made by the trading public, both before the Royal Commission of 1867 and the Select Committee of 1882, was, that the rates for conveyance of passengers and goods are unequal on different railways, and on different parts of the same railway, and that, in consequence of these unequal rates, some districts receive advantages which place them in a better position for competition than others.

The rights of the railway companies and of the public, respectively, in this matter are thus defined in the Railway Clauses Consolidation Act:—

"And whereas it is expedient that the company should be enabled to vary the tolls upon the railway, so as to accommodate them to the circumstances of the traffic, but

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that such power of varying should not be used for the purpose of prejudicing or favouring particular parties, or for the purpose of collusively and unfairly creating a monopoly, either in the hands of the company or of particular parties; it shall be lawful, therefore, for the company, subject to the provisions and limitations herein, and in the special Act, contained, from time to time to alter or vary the tolls by the special Act authorised to be taken, either upon the whole or upon any particular portions of the railway, as they shall think fit."

The competition in the carrying trade between the railway companies, and carriers on canals, roads, and rivers, as well as the whole coasting trade, had compelled the railway companies to reduce their rates in order to draw traffic on to their lines; and in the opinion of the Commission of 1867, this had been an unqualified gain to the general public, however much the owners of the rival methods of conveyance may have been prejudiced. The principle which is understood to govern a railway company in fixing a rate is that of *creating a traffic*, by charging such a sum for conveyance as would induce the produce of one district to compete with that of another and a common market.

Theoretically, no doubt this is quite correct; practically, it means that the caprice of the railway managers shall determine what district shall flourish, and what district shall fade. The Continent and the United States are common markets for the wire trade of Ambergate or Manchester or Warrington. What inducements have the railways serving these districts given to either district to enable them to compete in those markets? London is the common market for some Manchester goods, which are also manufactured in other Lancashire towns, and yet the railways give such "special rates" that, instead of sending their produce direct to London, the firms in question find it cheaper to transport it by railway to Grimsby or Goole, and thence by steamer to London—an operation that

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rather reminds one of Dick Swiveller's performance of going several miles round to get across the street.

Under the Traffic Act, the Court of Common Pleas distinctly recognised the right of a railway company to charge unequal rates (Ransome *v.* E. Counties Railway).

With regard to the common complaint that the system of unequal rates, in cases of traffic of the same nature carried from two several districts to a common market, has been so favourable to one district as to shut out the other, the Railway Commission of 1867 pointed out that there could be no mean course between allowing the railway companies to charge what rates they think expedient within a maximum limit, and requiring that a rate proportioned to distance, or at least an equal rate for equal distances, shall be adopted.

"Many important districts," they stated, "have access to each other by navigable rivers and by the sea, as well as by railways; and hence, if a uniform rate were made compulsory, it would prevent those districts which possess a water route as well as a railway from getting the benefit of the low rate they now obtain from the competition between the railway and the sea or river, and thus raise the price of the article to the consumer; or else, it would act as a prohibition to the railway companies whose lines are in competition with the coasting trade from carrying certain classes of traffic, and in either case would check trade. Moreover, the competition which now exists between the produce of different places in a common market would be seriously prejudiced by uniformity of rate."

Parliament has not only left the railway companies free to fix the rates, but has put no restraint upon the manner in which they may from time to time vary these rates. It was represented to the Commission of 1867, that it was a source of great inconvenience to traders, and in some cases attended with very serious loss, that rates were changed without any previous notice. The Commission

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did not think the suggestion that railway companies should be bound to give a very long notice to meet the convenience of persons who have entered into prolonged contracts, was well founded, as it was the obvious duty of such persons to guard, in the terms of their engagements, against a contingency known to exist. But, on the other hand, it is impossible to provide, in the ordinary current transactions of business, for a sudden change in the cost of conveyance, which may be a material item in the market value of a commodity. They therefore thought that railway companies should be compelled to give reasonable notice of any intention to raise their rates.

The Commissioners did not, however, consider that it would be expedient, even if it were practicable, to adopt any legislation which would abolish the freedom which railway companies enjoy, of charging what sum they deem expedient within their maximum rates when properly defined, limited as that freedom is by the conditions of the Traffic Act.

The following table shows the maximum rates authorised to be charged in their principal Acts by the leading English railways, in pence per ton per mile:—

Railways.	Coal, Pig Iron, Iron Ore, &c.	Corn, Timber, Sugar, &c.	Cotton and Manufactured Goods.	Fish, Feathers, Clothing, and Household Furniture.
	d.	*d.*	*d.*	*d.*
London and South-Western	2	3	3	5
Great Eastern . . .	1½ to 1½	2 to 2½	2 to 2½	4
Great Western . . .	0⅞ „ 2	2 „ 3	2½ „ 4	3 to 4
Great Northern . . .	0¾ „ 1¾	1¾ „ 2½	2½ „ 3	3 „ 3½
London and North-Western	0⅞ „ 1½	1½ „ 2½	2½ „ 3	3 „ 3½
Midland	1 „ 2	2 „ 2½	3 „ 4	3 „ 4

In spite of the obvious anomalies on the face of these rates, and in spite of the fact that no tribunal hitherto appointed to examine into the subject has been able to

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discover any principle upon which maximum rates have been fixed, or upon which the comparatively few articles enumerated in the special Acts have been classified,[1] these *maxima* still govern the imposition of traffic charges on all the leading railways of the United Kingdom.

In more recent railway Bills, clauses have been inserted requiring each company, under penalties, to give detailed information as to all its rates.

The Railway Commission of 1867 stated that, according to all the evidence brought under their notice, there was not any disposition "to afford personal preference for the special profit of individual traders;" but that the distinctions in rates made by railway companies were "based upon considerations affecting the profit and interest of the railway companies themselves."

The danger of preference arising under such a condition of things was fully recognised by the Commission, which recommended that the determination of rates should not be left to the good intentions of the railway companies, but that "any course which is practicable should be taken to ensure these intentions being carried into effect." As the best means to this end, the Commission recommended that the public should have the opportunity of becoming acquainted with all railway rates, charges, and dealings," so that the traders of each district, who might consider that their district was unfairly taxed, might have an opportunity of bringing their grievances forward.

But the Commission was scarcely consistent in its conclusions on this matter. After pointing out that the several leading Acts of Parliament required railway companies to charge "equally to all persons, and after the same rate, whether per ton per mile or otherwise," and that it was required by law that "all traders should be charged the same rate," under the same conditions, they proceeded to remark that "unequal rates are the essence of the present

[1] "Report from the Select Committee on Railways (Rates and Fares), for 1882," p. 7.

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railway system, and *as their discontinuance cannot be recommended*, the remedy against unfairness or oppression must be sought in publicity."

And then follows this somewhat remarkable *non sequitur*:

"We therefore recommend that, in order to enable all persons to be in a position to ascertain with ease whether they are treated on an equality with others, it should be compulsory on the railway companies, under adequate penalties, to exhibit at every station, when required, to the persons using the station, a true list of the whole of the fares and rates charged from that station, and to give full information as to special contracts, rebates, drawbacks, and other deductions or advantages. The Board of Trade, or other Government department charged with the supervision of railways, should further be empowered to require returns of all tolls and charges actually levied by railway companies, with full information as to rebates and deductions, or to appoint officers to examine the books of the companies."

Again, the Commission pointed out that, "in order that the public may satisfy themselves that the rates are equitably charged, it is necessary they should know accurately the distances between the several stations. The Railway Clauses Act stipulates that the distances shall be legibly marked along the line, and that no tolls shall be payable unless this is done. But this provision is not a convenient one to convey the information," and, therefore, the Commission recommended that "railway companies should be required, under adequate penalties, to publish accurate lists of the distances between the stations on their lines."

Many decisions have been given in the Courts relative to the much-vexed question of undue preference. One of the principal decisions bearing on this point is that of the Caterham Railway Company *v.* the London, Brighton, and South Coast Railway Company and the South-Eastern

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Railway Company, where the Court of Common Pleas held that higher charges on one branch line than on another do not constitute an undue advantage *per se.*

This view, however, was not supported by a decision given by Lord Justice Cockburn (Baxendale *v.* the Great Western Railway Company), who held that if a railway company, as between two intermediate stations, charged a higher rate than was due to intermediate space, in proportion to the charge made on the entire line of railway, the Court would—*if the disproportion were not justified by the circumstances of the traffic*—interfere to set aside such an arrangement. Again, it was the opinion of the same eminent jurist, that if a railway company charged more favourable terms for a larger than for a smaller amount of traffic, "although the Court might uphold such an arrangement as an ordinary incident of commercial economy, provided the same advantages were extended to all persons under the like circumstances, yet it would assuredly insist on the latter condition, and would interfere in the case of any special agreement, by which the company had secured to a particular individual the benefit of such an agreement to the exclusion of others."

If the decision of Lord Justice Cockburn were to be maintained in practice, no railway company would be in a position to do what probably every railway company in England does habitually at the present time, and has done since railways were in existence, viz., make differential rates in favour of particular districts or individuals. The well-known custom of the railways is to profess to carry out the spirit of the law, which requires that they should treat alike all traders in the same description of merchandise in the same localities, but they make differential rates by allowing large rebates and discounts; and there is probably no company that has not got secret arrangements of this kind.

The trading community of Great Britain feel dissatisfied that they are charged higher rates than their

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rivals abroad; but this they might submit to with tolerable equanimity, if it could be shown, as the railway companies pretend that it can, to be necessary to the traffic. It is, however, the persistent evasion of the law, in regard to the several provisions made for their special protection, that traders are most concerned about. For there is not a single trader in the country who is not well aware that the railway companies do not, as required by the Traffic Act, avoid undue or unreasonable preference or advantage in favour of particular persons or descriptions of traffic; that they do not, as required by the Railway Clauses Consolidation Act, "charge the same tolls equally at all times to all persons;" and that they do not, as required by the same Act, exhibit *all charges actually made* "upon one toll-board or more, in distinct black letters on a white ground," "in some conspicuous place on the stations or places where such tolls shall be made payable;" and that they do not "publish accurate lists of the distances between the stations on their lines." In a word, the essential requirements of these general Acts are evaded on every hand.

France.

According to the law of France, the railway companies are bound to submit to the Government all rates and fares charged for the transport of passengers and goods. No alteration can be made in such rates or fares, after reduction, for a period of three months as regards passengers, and of twelve months as regards goods. It is also required that the railway companies shall advise the Government as to every tariff modification, which must be advertised by placard a month beforehand. Should the Government make any alteration in a tariff, after it has been fixed by a company, the latter is bound to republish it; and in the event of failing so to do, the company is liable for damages sustained by any carriers who may be injured thereby.

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It is usually arranged that the expenses attending the loading and unloading of wagons shall be borne and controlled by the consignees. There is generally, however, a small terminal charge imposed, which is always a fixed one, and therefore readily ascertainable by the freighter.

Articles of light weight, in the transit of which speed is important, are conveyed at the speed of passenger trains (*grande vitesse*), while more heavy traffic is conveyed at a slower speed (*petite vitesse*).

In 1866, according to the Duke of Devonshire's Commission, the charges made for transport were, according to class, as under :—

First class	. . . . .	2.47d. per ton per mile.
Second „	. . . . .	2.16d. „ „
Third „	. . . . .	1.55d. „ „
Fourth „	for 200 kilometres .	1.24d. „ „
„ „	above 300 „ .	0.93d. „ „
Fifth „	for 100 „ .	1.24d. „ „
„ „	above 300 „ .	0.62d. „ „

In addition to these charges, 1s. 2d. per ton was required to be paid for loading, unloading, and station dues on small consignments, and 9.6d. per ton on full truck-loads; but when certain goods, in full truck-loads, were loaded and unloaded by their owners, they were subject to a terminal charge of only 3.84d. per ton.

The following statement, calculated from the official railway returns for 1883, enables the above figures to be compared with the rates of the principal French railways at a recent date :—

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Statement showing the Average Transportation Charges on the Leading French Railways.

Railways.	Tons Carried One Mile (1=1000).	Total Receipts (1=1000).	Average per Ton per Mile.
		£	d.
Nord	1,150,969	4,502	0.94
Est	845,255	3,409	0.97
Ouest	576,079	3,034	1.26
Paris and Orleans	1,071,093	5,009	1.12
P., L., and M.	2,329,432	9,634	0.99
Midi	546,090	2,726	1.20
Totals and average . .	6,518,918	28,314	1.04

The conditions of the two sets of figures are, of course, not strictly parallel, since it would be necessary, to a just comparison of the two periods, to be able to show what proportions of traffic in each class were carried at the earlier date. But since the ton-mile or kilometric rate for *all classes*, up to 100 kilometres, was considerably higher in 1866 than in 1882, it is clear that the general range of rates must have been higher at the former period —most probably from 40 to 50 per cent. more.

GERMANY.

Under Sect. 26 of the Prussian Code of 1838, the railways of that country are accorded, for the first three years after the opening of a line, the exclusive right of conveyance on it, and the right to fix the prices for the transport of passengers and goods, providing (1) that they make known publicly the tariff, and intimate advances of rates, six weeks before they take effect; and (2) that they forward, at their published tariff rates, all goods, without destinction of persons concerned. The rates and fares charged under this law were composed of two distinct items, the first being described as road-tolls, and the second as transport charges. The road-tolls were to be charged

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according to specific principles framed by the Council of Trade, and were to be revised at intervals of not less than three, nor more than ten, years. After the settlement of the road-toll tariff in this manner, the railways were at liberty to fix, at their discretion, the cost of transport for both passengers and goods; but it was provided that if the profits from this part of the undertaking exceeded 10 per cent., the rates were to be so reduced as to bring the profits down to that level.

The following figures show the ton-mile rates charged for goods traffic in the principal German States in 1863:—

States.	First Class.	Second Class.	Third Class.
	d.	*d.*	*d.*
Grand-Duchy of Baden .	2.20	1.67	1.41
Wurtemburg . . .	2.20	1.67	1.09
Bavaria	3.47	3.05	1.09
Austria	3.63	2.68	1.67
Eastern Prussia . . .	2.20	1.67	1.41
Hanover	2.83	2.20	1.09
Rhenish Prussia . . .	2.36	1.67	1.25

The classification was as follows:—

First class.—Manufactured articles, Colonial products, fish, &c.

Second class.—Machinery, raw cotton, wine, crude metals, &c.

Third class.—Coal, ores, building materials, pig iron, &c.

On the German railways, it has long been a recognised principle of tariff construction, that the rates charged should be such as to develop the greatest possible amount of trade; and hence, especially on the State lines, they have been very considerably reduced within recent years, according as the traffic has increased, and the working expenses have been reduced, absolutely and relatively. The following figures show the average ton-mile rates on the

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principal German lines, *for all descriptions of traffic*, in 1883, as calculated from official returns:—

Statement showing the Average Transportation Charges on leading German Lines.

Railways.	Tons carried One Mile (1 = 1000).	Total Receipts therefrom (1 = 1000).	Average Gross Receipts per Ton per Mile.
		£	d.
Bavarian State	714,324	2,881	0.97
William of Luxembourg . . .	489,700	1,580	0.77
Conscription de Berlin . . .	632,801	1,847	0.70
Conscription de Hanover . . .	837,312	2,679	0.77
Rechts Rheinisch	960,312	2,741	0.69
Links Rheinisch	490,811	1,624	0.79
Bergisch Märkische	777,774	2,619	0.81
Totals and average . .	4,903,034	15,971	0.78

The enormous reductions of rates that have, within recent years, occurred on the principal German railways are strikingly shown in these figures. The 4903 millions of tons of traffic transported one mile shown for the above seven lines, are approximately one-half of the total traffic movement in Germany for the year 1883. With reference to the other half, it is necessary to observe that the rates take a somewhat higher range. The average ton-mile rate found for the selected French lines is 33.3 per cent. higher than that found for the selected German railways. The six selected French lines, however, carried, in 1883, 10,350 tons one kilometre, out of a total of 10,937 ton-kilometres found for the country as a whole.

Belgium.

The history of railway tariffs in Belgium is very instructive—scarcely less so, indeed, than that of the railway tariffs of the United States.

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Up to 1856, the tariffs were generally high, and the progress of the traffic was very slow, sometimes, indeed, showing an absolute decline. In that year, in spite of an increase of railway mileage, the quantity of traffic carried on the Belgian State railways was less by 104,000 tons than in the previous year. This led the railway administration to reconsider their tariff policy, and to adopt particular contracts and special rates.

In 1861, the Government introduced the first regular tariff, with reduction according to distance. It embraced pit-coal, coke, coal-bricks, rough castings, flag-stones, building-stones, and lime. The results of this experiment were remarkable. The traffic rose 11.61 per cent. (427,000 tons) within a year.

In 1862 the special tariff became general—that is to say, it was extended to all goods of the third class. A tariff reduced according to distance was also made for the second class. The railways were worked under this *régime* during the years 1862–3, and the first five months of 1864.

In 1864, still more important reforms were decreed. All goods of the third class passed into a new class, at rates greatly reduced; the greater part of second-class goods were ranked in the third, and a certain number of products of the first class in the second and third. The *barèmes* of these two latter classes received the complement of reduction according to distance; and a reduced tariff was made for *abonnements*, &c. The effect of these measures was to suppress almost the whole of the contracts and special tariffs, the rates of the ordinary tariffs being equal to, or even lower than, those of favoured ones.

The results surpassed all expectation.

From June to December the tonnage of heavy goods increased by 525,000 tons, which represents for a period of twelve months a total increase of 900,000 tons. It is equivalent to the mean increase of more than three years together.

As to the receipts, the sudden change of which might

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have reached 2,000,000 francs, this development of traffic maintained them at a normal level.

In a report made by the Belgian Minister of Public Works in 1865, he remarked, with reference to these reductions of rates, that, since 1856, that is to say, in eight years—

"(1.) The charges on goods have been lowered, on an average, by 28 per cent.

"(2.) The public have despatched 2,706,000 tons more, while they have economised more than 20,000,000 francs on the cost of carriage.

"(3.) The public treasury has realised 5,781,000 francs more, after having paid the cost of working and the interest of capital.

"Being in this prosperous situation, the Government have asked if the time has not come to turn their attention to the second part of the problem of cheap transport —in other words, whether it is not proper to apply to the service of passengers the principles which have given such satisfactory results to that of goods.

"The Government is of opinion that facility and cheapness of travelling (*déplacements*) are in principle as fruitful in benefits to all classes of society as the economical transport of goods can be for the producers and for the consumers."

According to the Report of the Royal Commission of 1867, there were then on the Belgian Government railways four classes of goods rates, viz:—

	d.		d.
First class . . .	1.70	Third class . . .	0.89
Second class . . .	1.16	Fourth class . . .	0.62

This was in addition to a uniform charge of 1s. 1d. per ton in all classes; and 10d. per ton for loading and unloading. If collected and delivered, the charge was about 2s. 6d. per ton. Coals which were in the fourth class were carried specially for transit and export at .32d. per

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ton per mile, and occasionally at ¼d. per ton per mile, including wagons.

The following twenty years have not shown the same tendency towards rate reductions in Belgium as in some other countries. This, indeed, could scarcely have happened, considering that the Belgian Government recognised and provided for the lowest practicable rates at so early a period, and may, therefore, be said to have led the way in a movement that has since been of general range and application.

AUSTRIA.

The railway tariffs in Austria must receive the approval of the Ministry of Commerce and Public Works every three years.

If the net profits from railway working exceed 15 per cent., the Government has the right to make such reasonable reductions in the tariffs as it may deem desirable.

The mineral traffic of Austria-Hungary is not nearly so considerable as that of the other European States whose special circumstances have been considered. Nor is the tonnage carried so large, relatively to the mileage, and the cost of the installations.[1] This is, perhaps, the real explanation of the fact that the Austrian goods tariff rates generally take a higher range than those of either Germany or Belgium, as the following figures show :—

[1] For the year 1882, the average tonnage of goods traffic of all descriptions carried on the Austrian railways as a whole was 5138 tons per mile, against 8447 tons on the German, and 14,132 tons on the Belgian railways.

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Statement showing the Total and Average Receipts from Goods Traffic on Austrian Railways.

Railways.	Tons Carried (1 = 1000).	Total Receipts (1 = 1000).	Average Receipts per Ton per Mile.
	Miles.	£	d.
Hungarian State railways .	536,652	1,232	0.55
Elizabethbhan . . .	263,269	1,123	1.02
Franz-Josef-bahn . .	133,059	662	1.19
Nord-West-bahn. . .	215,676	1,040	1.16
Austrian State railways .	660,265	3,026	1.10
Südbahn	717,784	2,849	0.95
Totals and average .	2,526,705	9,932	0.94

It appears that the Hungarian State railways have a remarkably low range of rates, averaging, off and on, about one-half those found for the other railways dealt with. This is accounted for partly by the greater average length of lead, partly by the lower first cost, partly by the greater proportion of *petite vitesse*, and partly by the greater economy of management.[1] The 2526 millions of ton-miles shown for the above six systems represent fully 60 per cent. of the total goods traffic movement of the empire in 1883, so that the average shown may be accepted as a fairly typical one.

We have now seen, by a variety of facts, that the period between 1853 and 1863 marked a general movement in the direction of reducing the goods rates on the Continent. The movement applied equally to France, Germany, Austria, and Belgium. As an example of what was effected in this direction, it may be stated that up to the year 1863, the rate charged for all goods between the Prussian frontier town of Herbesthal and Antwerp was 1.03 francs per 100 kilogrammes; but in that year the rate

[1] One example of this difference is found in the fact, that on the Hungarian State lines the wagons were, in 1882, charged to within 55 per cent. of their capacity, while the general average found for the whole empire was 45 per cent.

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was reduced to 63 centimes, or very little over one-half. Again, between 1852 and 1861, the mean rate per ton per kilometre on the German railways was reduced from 0.0854 francs to 0.0664 francs, while the mean of passenger fares fell from 0.0639 francs to 0.0570 francs per kilometre. This apparent reduction, however, appears to have taken place mainly as a result of a larger proportion of third-class travellers.

There is no matter connected with our railway administration that is of more real importance to the general public than that of being afforded facilities for a comparison of one set of conditions and one period with another, in reference to rates and fares. It would not be difficult to furnish *data* of this kind, if only it were insisted upon by the Board of Trade. The railway returns made to that tribunal already show the number of miles travelled each year by both goods and passenger trains, as well as the total weight of goods, and the total number of passengers carried. Since this information is already demanded, there cannot be any real difficulty in the way of going a step farther, and demanding that each company shall keep and furnish a record of the numbers of passengers and of tons of goods traffic carried one mile, as is done in the United States and some other countries, and that, too, without any atttempt at compulsion. It is quite possible that railway managers might offer objections to the demand for this information, on the ground that it would tell too much; nor can there be any doubt that its effect would be to clear up a good deal that is now obscure as to the circumstances under which many companies carry on their operations. For it is obvious that if we had the number of tons, or passengers, carried one mile, and the receipts accruing therefrom, in reference to every railway company in the country, we should at once be able to arrive at the average ton-mile rate, and determine whether that rate were raised or lowered, as between one year or another. We should equally be in

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a position, with the returns of working expenses and net receipts already compulsorily made to the Board of Trade, to collate the net profit per ton per mile from one period to another, and by a judicious collation of allied and accessory facts, to put our fingers upon specific cases of extravagant charges, maladministration, and want of due economy. As the case stands at present, it is impossible for any one to determine whether the average ton-mile rate for the United Kingdom is higher or lower than it was ten or twenty years ago. The Board of Trade certainly acquaints us from year to year with the total tonnage carried, and the receipts therefrom, and it is thereby possible to form an estimate as to whether the amount received per ton carried is higher or lower, from year to year; but we cannot say whether it is more or less, in relation to the actual services rendered, seeing that the average length of lead, which is the true test, varies, or may vary, greatly from year to year, as to which, however, we are entirely in the dark.

Reference has already been made to the fact that the railway managers of this country profess that they are unable to furnish the exact cost of working any particular description of traffic. It would be extremely ungracious to suggest that it probably does not suit their purpose to know too much on this subject. But it is beyond all question, that if this item is not known on English lines, it is well enough known on foreign ones. It has been proved, for example, in the United States, that the cost of working goods traffic within the last few years has been reduced by one-half, and in some cases even more. We can hardly establish this proposition by returns that embrace the country as a whole; but it will be a sufficiently near approximation to the general tendency of both tariff rates and working expenses within recent years if we quote the experience of one of the leading lines—the New York Central and Hudson River Railroad—which is set forth in the table that follows:—

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Statement showing the Growth of Traffic on the New York Central and Hudson River Railroad between 1854 and 1884.

Years.	Miles Open.	Gross Freight Earnings (1 dol. = 1000).	Gross Earnings per Mile.	Tons Moved One Mile (1 = 1000).	Per Ton per Mile.		
					Gross Earnings.	Expenses.	Net Earnings.
					cents.	cents.	cents.
1854 . . .	804	2,944	3,662	99,310	2.95	1.30	1.64
1860 . . .	804	4,943	6,148	239,419	2.06	1.34	0.72
1865 . . .	804	11,000	13,681	318,732	3.45	2.53	0.91
1870 . . .	842	14,327	17,015	769,088	1.85	1.16	0.71
1875 . . .	1,000	17,899	17,899	1,404,008	1.27	0.90	0.37
1880 . . .	1,001	22,199	22,176	2,525,139	0.87	0.54	0.33
1883 . . .	993	20,142	20,284	2,200,897	0.91	0.68	0.23

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Briefly stated, the remarkable lesson to be learned from this table is, that since 1870—to go no farther back—the cost of transport has been reduced by more than one-half, and so also with the working expenses, as calculated on the ton-mile basis; and that the net receipts per ton per mile have fallen from 0.71d. to 0.23d. during the same period. This decrease under every heading has nothing to do directly with the cost of constructing the railway, on which English managers lay so much stress. It is really a movement, regard it as we may, that should have, if it has not actually had, its counterpart on the railways of the United Kingdom. But then the American and the British lines are differently situated in the matter of competition, which is the crux of the whole matter. Here is how competition affects the United States:—

"Rates and discriminations are not entirely within the arbitrary determination of railroad companies. They are subject to competitions, which they cannot control, upon the ocean, upon the lakes, and upon the rivers. There is scarcely a centre of business in the country, affording any considerable freights, where they are not fiercely contended for upon all available national highways, as well as by canals and competing roads, with the necessary result of practically reducing all competing rates to the level of the lowest."

"The great lakes and rivers, so peculiarly and advantageously located as to trade, with their numerous far-reaching and widely extended navigable tributaries, carry water competition into almost every portion of the country, with the effect of so reducing the general rates that the United States enjoy the cheapest railroad transportation in the world."[1]

The leading English lines, by throttling our canal system, have seemingly rendered it impossible to reproduce in Great Britain the very healthy and beneficial experience of the United States.

[1] Report of the Secretary of the Interior for 1882.

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CHAPTER XXI.

AMERICAN RAILROADS.

"The railroads of the United States, by revolutionising the agriculture, are revolutionising the political systems and institutions of the Old World." —*Poor's Manual for* 1881.

THAT the United States are a great nation is a fact of which Europe is frequently, and perhaps rather too obtrusively, reminded. It is a nation great in area, great in population, great in resources, great in variety of climate, great in natural waterways, in agriculture and manufactures, in prosperity and accumulated wealth, and in a hundred other directions scarcely less important. But what we have now specially to deal with is the greatness of the United States in reference to railway development. Within the limits of United States territory—within that compact, homogeneous, closely knit, and widely ramified nation, there has been laid down, something approaching one-third of all the railways constructed throughout the world. This is a proud boast. It is a tribute paid to the immense utility of railway facilities by the most enterprising and energetic people in the universe. It is, however, not alone in regard to the extent of their system, enormous though that be, that the people of the United States occupy an unique and pre-eminent position. They are equally *sui generis* in reference to the high perfection, in an economic point of view, to which they have succeeded in bringing their railway practice. The country does not naturally offer any exceptional advantages of

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facilities for the attainment of this end. Labour is exceptionally dear, as well as the materials that generally enter into railway construction on a large scale. The gradients and alignment are, it is true, often very favourable, but not more so, on the whole, than some European countries. And yet the railway system of the United States has advanced by leaps and bounds, until, within an interval of less than a single decade, it has enabled the enormous agricultural and manufacturing interests of the country to command the cheapest freights of any nation in either the New World or the Old.[1]

To the people of both hemispheres, to the railway interests, as such, and the great public whom they serve, to the political economist and the statistician, and to all who take an interest in, or are in any way affected by, the conditions of material development—and who is not?—it is of consequence to measure the extent and the results of this remarkable outcome of American capacity, American necessities, and American competition. We propose, therefore, to examine the various aspects of this problem at some little length, believing that our proposed investigation will be well rewarded by the results.

The railway system of the United States is not comparable with that of Europe only in respect of its almost equal extent. It is equally varied and complex in its characteristics of cost, traffic, earnings, and other prominent features—so much so, indeed, that, although nominally belonging to the same nation, the railroads of no two States are quite, or even very approximately, alike. These differences of detail are rendered more striking by the circumstance that practically each State controls its own railway system. The air of freedom and absence of irksome restraints that is so marked a feature of the political institutions of the United States, is almost equally to be traced in the laws affecting railroad construction. There

[1] In making this broad general assertion, the specially low rates of freight on some Indian railways are left out of account.

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is practically no control exercised by the Executive Government over the schemes put forward with this intent. Any one is at liberty to put down railways on United States territory, very much as and how he pleases. There is no preliminary sanction of Parliament to be applied for, as in this country. There is no tribunal corresponding to the Board of Trade, to demand that an infinite variety of costly and irksome, if necessary, conditions shall be complied with before a railway shall be allowed to commence business. There is no special exemption from the competition of rival concerns, as in Germany and Belgium; nor does the State, as in most Continental and some Colonial countries, afford large financial assistance to railway promoters.[1] The rule is, that a line likely, or believed to be likely, to pay, is resolved upon by parties interested, who accept all responsibility, both as to capital and as to details of construction; and the railway is opened and controlled subject only (except as to a few general regulations applicable to all alike) to the special laws of the State or territory in which it has been laid down.

There is, however, another feature that pre-eminently distinguishes American from European railroads. It is, no doubt, a great gain, from the promoters' point of view, that there are so few restraints imposed upon the conditions of construction and working; but it is not only this negative form of consideration and relief that has been vouchsafed to the United States railroads. A more positive and substantial aid has been accorded to the principal trunk lines in the form of land grants, made by the State, as such. These grants have been made in two ways. They have been made directly to the companies owning or working the Pacific lines; and they have been made through the agency of particular State Governments.

[1] This is true of railways in general; but it should be remembered that, in addition to the land grants, which have been awarded to most of the principal lines, special financial aid has also been accorded to several of the main trunk lines in the United States.

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The system of allotment has not been uniform throughout. The Union Pacific, for example, had received, to the end of 1884, 2,305,024 acres for 1834 miles, whereas the Northern Pacific, to the same date, only received 746,390 acres for 2453 miles of road. They are, however, in all cases, such as to greatly relieve the original cost of construction, not only by allowing the railways to acquire the land necessary for their purpose without cost,[1] but also by affording a large margin to aid in the ultimate cost of construction from the sale of the land accruing to the railways. In regard to the latter element of gain, the advantages are, no doubt, likely to be realised very slowly, and it is, perhaps, doubtful whether they will materially affect the cost of construction during the first ten or fifteen years of a line being opened in a very sparsely-populated district; but they are none the less calculated to induce the development of new lines in districts where they might not otherwise be laid down for many years later, and thus to explain the unique position which is occupied by the United States in regard to railway mileage.

The fact that the American railroads have been constructed without any considerable, and in very many cases with absolutely no expense on account of land purchase, explains to some extent their generally low capital cost by comparison with European lines. There are, however, very remarkable differences as between one State and another in this regard, which are not by any means adequately explained by differences in the cost or concessions of land. Thus, we find that in the New England States, the cost of road and equipment ranged,

[1] It is not to be assumed that all, or even the majority of railways have been endowed in this way. The Census Report on American railways shows, on the contrary, that, on the mileage constructed to the end of 1879, 20½ million dollars had been expended for land, which represents an average of £234·7 per mile of line constructed.

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at the end of 1884, from a minimum of 30,000 dollars per mile in New Hampshire, to a maximum of 80,000 dollars in Massachusetts. In the Middle States, the variations ranged from a minimum of 29,000 dollars in Delaware to a maximum of 106,000 dollars in New Jersey; and even in the Pacific States we find such disparities as 31,000 dollars per mile in Utah, and 87,000 dollars in California.[1]

Then, again, it seldom happens that in the United States the cost of a railway and its equipment corresponds, as it ought to do, to the total capital expenditure. There is no country in the world where the business of watering stocks is better understood or carried out more systematically, and on so large a scale. For this reason, there is liable to be a great deal of error entertained in reference to the actual cost of American lines.

It may be well to furnish a few examples of what is meant. In the case of the Pennsylvania railways, the total cost of the road and equipment is returned at 471 millions of dollars, but the total capital expenditure is placed at 823¾ millions of dollars, or 58 per cent. more. Of the difference, it is probable that a considerable share has been expended in the purchase of coal-lands, &c., but it is no secret that a large part of it is simply "watered" capital, for which no equivalent whatever has been received. There are many similar, if not equally flagrant, examples.

In 1872, the difference between the total cost of American railways and their equipment, and the total capital of the system, was 85¼ millions of dollars. In 1884, this sum had been increased to upwards of 162 millions of dollars. In 1872, the watered capital amounted to an average of about 1800 dollars per mile, but in 1884, the average of such capital was only 1343 dollars per mile. At the end of 1884, fully 10 per cent. of the total capital embarked in American lines was additional to the actual cost of the railways and their equipment, and the greater part of it may be regarded as representing "watered" stock.

[1] "Poor's Manual of Railroads of the United States for 1884."

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Nevertheless, the average cost of the American railroads has been, and continues to be, considerably under that of Europe. In 1872, that average was just £9000 per mile. In 1883, it had increased to £11,092 per mile. This increase of £2092, or 23 per cent. per mile of line open, is to be explained by a number of circumstances that have applied, in greater or less degree, to almost every country of importance. It has been created, as regards the United States, partly in consequence of an increased mileage of double line, partly because of a better alignment, increased stability, heavier rails, and superior traffic facilities and accommodation. As they now generally stand, European railroads have cost an average of £24,950 per mile, against an average of £11,092[1] for the United States, making a difference in favour of American lines of £13,858 per mile, or 55 per cent. This difference is so remarkable, that we might well be excused for inquiring into its causes; but as these will be more or less referred to in other parts of this work, we shall simply add here that the chief has been the generally low cost of land, and the more unsubstantial character of the works of construction. The United States, moreover, have probably a larger proportion of flat surface, relatively to total area, than any European country except Holland, and the cost of embankments, viaducts, &c., which are the most expensive items in railway construction, has thus been brought down to a minimum.

The total cost of the railways of the United States to the 1st June 1880, is thus stated in the Census Report for that year:—

[1] This figure is the cost of the road and equipment only, the average capital expenditure, as ascertained by dividing the open mileage into the total capital expenditure, being £12,435 per mile. There is no account of the proportion of the total capital expenditure on European lines that is due to the cost of road and equipment alone.

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Statement showing the several Items of Cost involved in the Construction of the Railways of the United States in 1880.

Items.	Totals.	Average per Mile.
Construction of road . . .	£822,400,000	£9,368.9
Equipment	83,000,000	945.5
Lands	20,600,000	234.7
Stocks	36,900,000	439
Bonds	31,800,000	369
Telegraph lines and miscellaneous .	40,900,000	487
Total permanent investments .	£1,035,600,000	£11,798

It is a matter for regret that there exist no *data* that would enable a comparison of these several items to be made with the corresponding items for European railways.

The cost of construction and the efficiency for traffic purposes of a railway system, are necessarily more or less affected by the proportions of single and double track. In the early history of the railroads of the United States, single track was the almost invariable rule. As the traffic increased, and with it the resources at the command of the several companies, the mileage of double track was largely augmented. At the end of 1883, there were 149,181 miles of track, and 120,549 miles of line open. The comparative cost of each, for the several groups of States, was as under:—

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Statement showing the Capital Expenditure per Open Mile and per Mile of Track on the Railways of the United States in 1884.

Groups.	Total Line.	Total Track	Total Capital (1 dol. = 1000).	Capital per Mile of	
				Line.	Track.
			dols.	dols.	dols.
New England .	6,322	9,063	360,317	56,994	39,205
Middle . .	17,531	27,776	2,012,536	114,800	72,098
Southern . .	18,865	21,465	888,304	47,087	41,384
Western . .	70,345	82,550	3,681,034	52,328	44,592
Pacific . .	7,486	8,327	553,281	73,908	66,444
United States .	120,549	149,181	7,495,472	62,178	50,244
Do., 1882 . .	114,461	140,960	7,016,750	61,303	49,778

It will be noted that, even in reference to the mileage of *single line* open, there have been enormous differences of cost, the New England States showing the minimum of 39,205 dollars, and the adjacent Middle States the maximum of 72,098 dollars. The difference is largely a reflection of the superior strength and stability of the work executed in the Middle States; but, as regards the Pacific States, the high average capital cost per mile of track has no doubt a close relation to the higher cost of labour and material.

For the purpose of exhibiting in a compendious form the leading financial features of American railroads, and of indicating their principal tendencies within recent years, we have, in the following table, shown the principal *data* for the years 1872 and 1883 :[1]—

[1] In the compilation of this table, we have made use of the *data* given in Mr. Giffen's valuable work on "American Railroads as Investments," as regards the year 1872.

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Statement showing the Circumstances of American Railways in the Years 1872 and 1883.

Items.	1872. Mileage, 48,022. Totals.	1872. Mileage, 48,022. Average Per Mile.	1883. Mileage, 120,549. Totals.	1883. Mileage, 120,549. Average Per Mile.
Total capital	£518,642,000	£10,800	£1,499,094,200	£12,435
Stock	275,644,000	5,700	744,812,000	6,154
Funded debt	224,142,000	4,700	691,008,000	5,732
Floating debt	17,268,000	360	66,474,000	551
Cost of road, equipment, &c.	433,267,000	9,000	1,336,951,000	11,092
Gross earnings	76,591,000	1,595	164,754,000	1,492
Earnings from passengers	22,301,000	...	41,367,000	390
Earnings from goods	50,195,000	...	108,901,960	1,018
Earnings from other sources	4,095,000	...	14,487,000	120
Proportion of passengers to total earnings	29 per cent.	...	25 per cent.	...
Working expenses, rents, &c.	£49,931,000	1,040	£97,372,000	824
Proportion of expenses to gross earnings	65 per cent.	...	59 per cent.	...
Net earnings	£26,660,000	555	£67,382,000	540
Proportion of net to gross earnings	35 per cent.	...	40 per cent.	...
Percentage of net earnings on capital	£ 5 2 11 per cent.	...	£4 10 0	...
Percentage of net earnings on cost of road, equipment, &c.	6 3 1 per cent.	...	5 0 9	...
Percentage of net earnings on funded and floating debt	11 0 10 per cent.	...	8 17 0	...

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This table is in every way remarkable, and is likely to repay careful perusal. It shows, among other striking facts, that there has been a fall in both gross and net earnings per mile of line open; that the goods traffic has in America, as in our own country, been growing in relative importance; that the working expenses per mile have been largely reduced, and were only 59 per cent. of the gross earnings in 1883, as against 65 per cent. in 1872—a result that presents a remarkable contrast to the experience of British lines within the same period;[1] and that there has been a consequent increase in the proportion of net to gross earnings. On the whole, it is not too much to say that the comparison redounds to the credit of American railway administration.

With a view to enabling the foregoing returns to be compared with similar returns for the United Kingdom, we have prepared, in a somewhat different form, a table in which the principal *data* for passenger and goods traffic are set forth:—

Statement showing the Revenue Train Mileage for the United Kingdom and the United States, respectively, in 1880.

Items.	United States.	United Kingdom.
Miles of line open	87,782	...
Earnings per mile	£1,322	£3,800
Expenses per mile	£,804	£2,000
Net earnings per mile	£518	£1,800
Mileage (freight trains)	251,022,710	127,618,000
Earnings per mile	5s. 5½d.	6s. 1d.
Expenses per mile[2]	3s. 11d.	[3]
Net receipts per mile	2s. 9½d.	[3]
Mileage of passenger trains	138,225,621	138,175,000
Earnings per mile	4s. 8½d.	4s. 3d.
Expenses per mile[2]	3s. 2d.	[3]
Net receipts per mile	1s. 9½d.	[3]

[1] In England and Wales, in the same interval, the working expenses rose from 49.5 to 52.6 per cent. of the total traffic receipts.

[2] Includes expenditure on partly completed roads under construction.

[3] The Board of Trade returns do not distinguish the expenses of working passenger and goods traffic, and the net receipts from each are also, for that reason, not ascertainable.

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We have now seen, in a roughly approximate way, what American railroads are. It still needs that we should approach what is probably the most interesting part of this inquiry, and consider what they have done.

Mr. Edward Atkinson of Boston declares that American railways have been "the prime factor in enabling the people of the United States to overcome the losses of the Civil War, in enabling the Government to resume specie payment, and in establishing prosperity on a solid basis."[1]

These are strong, and some will be likely to say, most singular claims. They are, nevertheless, not too strong, however singular.

From a variety of causes, the railroads of the United States have within the last twelve or fifteen years accomplished one of the most remarkable economic revolutions of either ancient or modern times. The average rate at which the goods traffic of the country is carried has been reduced by something like one-half, and, in some exceptional cases, by much more even than that.

In the preceding chapter (p. 305) we have shown that on the New York, Central, and Hudson River line, between 1865 and 1883, the average gross earnings received from all descriptions of traffic fell from 1.72d. to 0.45d., the average expenses from 1.26d. to 0.34d., and the average net earnings from 0.45d. to 0.11d. per ton per mile. The New York Central line had, therefore, in 1883 reduced its average profit for moving a ton of freight one mile to a fraction over a tenth of a penny. In other words, one ton was moved fully nine miles, or nine tons were moved one mile, for less than a penny! It certainly does not look as if there was a margin here for further reduction.

It has been ascertained that the experience of the New York, Central, and Hudson River Railroad has been typical of, and strictly analogous to, that of the chief railways throughout the country. The average reduction of goods traffic rates over the period under consideration

[1] Pamphlet on the Railroad and the Farmer, New York, 1883.

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has been quite one halfpenny per ton per mile. This means an average annual reduction, on the present goods traffic movement of the United States, of quite *one hundred millions sterling per annum!*

What other economic movement of recent times has accomplished such a result? Let us try to appreciate what these figures mean.

A hundred millions sterling per annum is considerably more than the total annual income of the United Kingdom for army, navy, and all other expenses of Government. It is about one-seventh of the national debt, so that our enormous fiscal burdens might be wiped off within eight years by the savings of which the railroads of the United States have within the last decade annually made a present to the people of that country. A hundred millions sterling is *thirty millions more* than the total annual income from all sources of the railways of the United Kingdom, and nearly double the present total annual income from British agricultural rents.

This colossal concession to the trade and industry of America has had both immediate and far-reaching consequences. Its more immediate effects have been to enable the remotest cattle-breeder and wheat-grower in the United States to obtain access to other markets than his own, and thereby to enter into the world's competition for the supply of the world's markets. Its ultimate results are to be witnessed in the extraordinary cheapness of the bread-stuffs furnished to England by the United States, and, as a necessary consequence thereof, by other countries; in the singularly severe and protracted depression of British agriculture; and in the complete discomfiture of many interests that were fairly strong and capable of holding their own until this fiscal monster came to the front.

It is, therefore, not too much to say that the railway rate wars and reductions in the United States have not been the least potent cause of the seriously depressed

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condition of commerce and agriculture throughout Europe at the present time, and that they have exercised an equally potent influence in the development of the same interests in the country in which they have occurred.

On some of the principal American lines, the average rate per ton carried one mile has been reduced to less than one halfpenny. The following shows the average rates on a number of the principal lines in 1880:—

Statement showing the Average Tonnage of Goods Traffic Carried on the Fifteen Leading Railways of the United States in 1880.

Railways.	Tonnage Carried (1 = 1000)	Tons Carried One Mile (1 = 1000).	Average Length of Lead.	Average Receipts per Ton per Mile.
	Tons.	Ton-Miles.	Miles.	Cents.
Pennsylvania . . .	25,016	3,165,725	126	0.89
New York Central . .	10,533	2,525,139	240	0.86
Lake Shore and Michigan .	8,350	1,851,166	222	0.76
New York and Lake Erie .	8,715	1,721,112	197	0.84
Baltimore and Ohio . .	10,108	1,725,855	171	0.89
Central Pacific . . .	1,829	449,580	246	2.49
Chicago, Burlington, and Quincy	4,948	1,173,001	237	1.11
Philadelphia and Reading .	12,636	834,431	66	1.61
Chicago and North-Western .	5,328	816,739	153	1.47
Union Pacific . . .	992	436,054	440	1.99
Chicago, Milwaukee, and St. Paul	2,927	442,907	151	1.72
Chicago, Rock Island, and Pacific	2,966	664,861	224	1.21
Wabash, St. Louis, and Pacific	3,919	947,369	242	0.80
Michigan Central . . .	3,656	727,254	199	0.80
Atchison, Topeka, and Santa Fé	872	266,174	305	2.09
Totals . .	102,801	17,747,375	172	1.05

On seven of the principal American railroads, therefore, the average rate per ton per mile in 1880 was less than one halfpenny, while on one line—the Lake Shore and Michigan—it was only about three-quarters of that humble coin. This, be it remembered, was the average charge for *all traffic*, and not for one description only. It compares

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very favourably indeed with the lowest European averages, which we have shown elsewhere (p. 277) to be 0.76d. per ton per mile in Holland, and 0.77d. per ton per mile in Belgium. So far as England is concerned, there is no clue, as we have elsewhere shown, to the average ton-mile rate; but on the great coal-carrying lines, where the lowest rates are to be found, the average ton-mile charge for the transport of that mineral to the metropolis in full train-loads is as nearly as possible identical with the average of the United States railways for 1880, *as applied to all descriptions of traffic.* It is probable that the average ton-mile rate on English railways will not be much, if any, under 1½d., which is just three times the amount charged on the principal American lines, as already ascertained. If the assumed English average were now charged on the American railroads, the income of the latter, on the freight carried in 1884, would have been 200 millions sterling more than it really was!

It is not, however, to be supposed that all American railroads are alike. On local lines, with a short average length of lead, the average ton-mile rates are higher than on the great trunk lines, where the traffic is much heavier, and the length of lead much longer. This explains the fact that, if we take the average of a State, or group of States, we shall find the average ton-mile rates higher than on individual lines. In the States that have the shortest leads, the rates are the highest; and hence, among the New England States, Rhode Island comes out with an average of 3.4 cents, while Massachusetts has only 1.6 cents per ton per mile. The average of New York State, taking both short and long lines, is, however, under ½d. per ton per mile, and the average of the whole of the New England and Middle States in 1883 only amounted to 1.1 cent per ton per mile. On all railways alike, so far as the available *data* throw light upon the real facts, there has been a substantial reduction of rates within the last twelve or fifteen years, although, as will be seen from the

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following table, there are large variations of charge as between the several States:—

Statement showing the Number of Ton-Miles on the Railroads of the New England and Middle States of America in 1883, and the Average Rates per Ton per Mile.

States.	Number of Tons Carried One Mile (1=1000).	Gross Earnings from Freight (1 dol.=1000).	Average Rate per Ton per Mile.
	Ton-Miles.	Dols.	Cents.
Maine	159,984	2,776	1.7
New Hampshire	140,327	2,383	1.7
Vermont	232,248	2,774	1.2
Massachusetts	1,015,644	16,492	1.6
Rhode Island	16,796	574	3.4
Connecticut	242,114	5,438	2.2
Total, New England	1,807,113	30,437	1.7
New York	6,040,404	55,371	0.9
New Jersey	1,140,071	14,369	1.3
Pennsylvania	7,859,109	85,612	1.1
Delaware	14,146	488	3.4
Maryland	996,144	10,649	1.1
West Virginia	50,180	610	1.2
Total, Middle States	16,100,054	167,100	1.0
Totals and average	35,814,334	395,073	1.1

We have now to consider the twofold problem, Why has this been done, and how has it been done? In examining these two points, we would ask the railway authorities of Europe to read, mark, and learn, with the closest attention, the facts that we are about to state.

It is not for a moment pretended that a sense of duty, or motives of practical benevolence, have been at the bottom of the revolution in railway rates that the United States have witnessed during the last few years. American railroad managers are scarcely the men to allow either consideration to influence their command over the

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almighty dollar. They are not, perhaps, in this respect either better or worse than their English and Continental congeners. Their *motif* in the majority of cases is identical with that of which we are so fully cognisant in England—to impose upon the traffic as high rates as it will bear, and *competition will allow them to secure.* The latter is especially the determining consideration. Most of the great trunk lines in the United States are exposed to competition from other lines of railway, from canals, from lakes, and from rivers. This competition has compelled them to so set their house in order as effectually to meet it. They have met it in no half-hearted fashion, but with a measure of energy, capacity, and large-heartedness that will ever redound to their credit.

It would be an easy matter to adduce statistical evidence of the effect of canal and lake competition in reducing the freight charges on the American railways. If we take the commerce of the city of St. Louis, as a case in point, we find that in 1871, 33.68 per cent. of the whole was received and shipped by river, and 66.32 by railway. In 1882, the proportion received and despatched by railway had increased to 87.14 per. cent., while that falling to river transportation had fallen to 12.86 per cent.

Again, the receipts of grain at New York rose, between 1871 and 1880, from 52½ to 71 millions of bushels by canal, and from 34 to 95½ millions of bushels by railway. There was, therefore, an increase of 36 per cent. by canal, and of 180 per cent. by rail.

Corroborative evidence is furnished by the ton-mile movement of traffic on the New York State canals, and the New York Central and New York, Lake Erie, and Western Railways, respectively. Between 1870 and 1880, the tons carried one mile on the canals only increased from 904¼ millions to 1223½ millions, while the movement of traffic on the two competing railroads specified rose from 1668 millions to 4246 millions of ton-miles.

It is clear, therefore, that canal competition has had a

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very great deal to do with the lowering of rates on the railways of the United States. In a scarcely minor degree, the rivalry of the railroads with each other have contributed to the same result. Neither cause is at work to any material degree in England, since canal competition has virtually been rendered impossible, by the control that has been acquired over the canal system by the railway corporations; and the railways endeavour, in a great many cases, where there is a plurality of routes to the same centres, to arrange the rates on a common basis.

But how, it may well be asked, has it been possible for American railways to make an annual concession equal to 100 millions sterling to the trade and commerce of the country, and yet maintain their solvency? This is, in truth, at once the most remarkable and the most apparently incredible feature of the whole matter; nor is the matter rendered more intelligible, on the face of it, when we find that, concurrently with this enormous reduction of traffic rates, the American railroads, as a whole, have increased their percentage of net receipts, or profit, on the cost of their construction, from 2.8 per cent. to 5.4 per cent., between 1871 and 1884.

English railway directors and engineers are accustomed to observe—"Oh, yes; we hear all that you say about the remarkable reductions of freight on American railroads, and it looks very pretty on the face of it; but before we accept it as gospel, we should like you to tell us how it is done."

To answer this interrogatory satisfactorily would practically involve a history of American railway development over the last fifteen or twenty years. The economy of which American railway administrators are so proud has not been the product of any one influence or improvement. But it has been mainly attributable to—

(*a.*) The increase in the capacity of the goods wagons relatively to the tare.

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(*b.*) The increase of the average load hauled per train.
(*c.*) The increased duty got out of the locomotives.
(*d.*) The better condition of the permanent way, and consequent economy of repairs.

The type of wagon or car generally adopted on American lines is now very much larger than that of a few years ago. Until 1876, the standard capacity of the ordinary goods wagon was about nine gross tons. About 1877, the capacity was increased on several lines to twelve tons, and since 1879 there has been a further increase to about eighteen or twenty tons. The comparative weights of a Pennsylvania Railroad box-car in 1870 and 1881 were as under:—

	1870.	1881.
	lbs.	lbs.
Weight of car . . .	20,500	22,000
Weight of load . . .	20,000	40,000
Totals . .	40,500	62,000

showing for 1870 a live or paying load that was only 49.38 per cent. of the total, as against 64.52 per cent. of the total in 1881, or an increase of 15.14 per cent. in the latter year. This increase is so much clear gain to the railway companies, since the road has been strengthened and improved to support the larger loads, and the wear and tear is not appreciably greater. Concurrently with the adoption of a larger size of wagon, the live load has been considerably increased. On the Pittsburg, Fort Wayne, and Chicago Railway, for example, the average load per wagon has been increased from 7.98 tons in 1867 to 10.65 tons in 1881, an increase of about 33 per cent.[1]

We have next to consider the extent and the effect of

[1] Official Report on the Internal Commerce of the United States for 1882.

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the increase of the average load carried on American lines. The progress that has been made in this direction is a matter of common knowledge in the United States. On the several divisions of the Pennsylvania Railroad, which may be regarded as a type of the practice of the best lines, the average number of tons hauled one mile per locomotive increased from 2.1 millions in 1870 to 5.1 millions in 1881, being an increase within eleven years of 143 per cent.[1] On the Pittsburg, Fort Wayne, and Chicago Railroad the average tonnage carried in goods trains rose from 102.8 tons in 1867 to 171.53 tons in 1881, being an increase of 66.9 per cent.; and on the Philadelphia and Erie road, within the same interval, the average load increased from 118 to 275 tons, or 133 per cent. The increase of load over the whole of the principal lines may not be quite equal to this high figure, but it has been of such general application as to have powerfully contributed to the result under consideration.

The third means of increased economy that has been specified—the increase of duty got out of the locomotives employed on the American railroads—has almost been identical with, and consequent upon, the greater average weight of the trains already referred to. But it is not only that the locomotives have been designed and built to carry heavier loads; they have also accomplished a much greater average mileage. On the Pennsylvania Railroad, for example, the average distance covered by each locomotive in 1881 was 29,297 miles, as compared with 19,888 miles in 1870, showing an increase of 9409 miles per locomotive, or about 47 per cent. This, of course, represents the employment of a very much smaller ratio of rolling stock to freight carried. It is, therefore, clear that, measured by the ton-mileage test, which is, perhaps, the best one that could be applied, each locomo-

[1] See Mr. W. P. Shinn's Report on the Efficiency of the American Railroad System, in the Official Report on the Internal Commerce of the United States for 1882.

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tive employed on this important system was made to do 143 per cent. more work in 1881 than in 1870. Surely this, of itself, is enough to convince the most sceptical as to the real import of the economies in question.

But it is possible that railway authorities, who are little in love with American practices and claims, may be disposed to argue that this great increase of work per locomotive must have been attained at a very serious proportionate increase of cost in fuel and repairs. This has really not been the case. On the contrary, it is found, on the Pennsylvania line, that the average cost of repairs per locomotive, per 100 miles run, fell from 16.45 dollars in 1865, and 9.13 dollars in 1870, to 6.02 dollars in 1881, being, as compared with the highest figure, a fall of 10.43 dollars per 100 miles. If the same average fall had occurred over all the mileage open in the United States, it would mean that in 1883, when 389 millions of train-miles were run, the cost of locomotive repairs would be 40 millions of dollars less than it would have been in 1865 for the same train-mileage.

Among minor sources of economy, but yet important ones, may be named the consolidation of connecting lines under one management, with the effect that, whereas, in 1860, it rarely happened that 500 miles of railroad were under the same administration, the rule now is to have from 1000 to 3000 miles so controlled; the running of freight trains at higher rates of speed;[1] the adoption of a system known as "running locomotives, first in, first out," under which, by having more crews than locomotives, nearly 50 per cent. more service is got from the latter, with less deterioration, due to frequent alterations of heating and cooling; the running of cars through from the centres of production to tide-water without transhipment; increased terminal facilities; and improved methods of signalling.

[1] In 1867, it was believed by high railway authorities, and actually resolved on the Pennsylvania Railway, that the speed of goods trains should not exceed an average of 6 miles an hour; but, with better permanent way, 15 to 20 miles per hour has now become the rule.

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CHAPTER XXII.

COLONIAL RAILWAYS.[1]

THE subject of the railway development of our colonies is one of the greatest possible importance, not only to the inhabitants of "Greater Britain," but also, and in a scarcely less degree, to the mother-country as well. There are several reasons for this undoubted fact. The most obvious, and the one that is at once likely to occur to the mind, is that the mother-country has hitherto been, and is likely for a long time to remain, the chief source whence the colonies draw the materials necessary for the construction and working of their railways. But there is another, and perhaps a more paramount, reason than this, since every increase to the railway resources of our colonies provides them with additional facilities for opening up their immense virgin lands; for promoting their population and prosperity; for exporting their own produce, and importing that which Europe, and especially the mother-country, sends them in return; and, finally, for supplying the inhabitants of these islands with the food which we are increasingly unable to grow at home.

It is manifestly not an easy matter to compress, within the short space of time available, the salient features of so vast a question as that of colonial railway development. At the very threshold, we have to face the difficulty of how to treat the subject, which, to do it justice, should

[1] This chapter was read as a paper at the Colonial and Indian Exhibition on July 27th, 1886—the Right Hon. A. J. Mundella, President of the Board of Trade, in the chair. An abstract of the paper, nearly two columns long, appeared in *The Times*, together with a leading article, commending its conclusions.

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be examined from many points of view, and especially from those of the economist, the engineer, the investor, and the general public.

If we take our fifteen principal colonies, including India, Canada, and the Australias, we find that they possessed a total of about 30,000 miles of railway at the end of 1884, being one mile of railway to every 269 square miles of area, and every 7379 inhabitants. In the United States, there is one mile of railway to every 25 square miles of area, and every 2321 inhabitants. In the United Kingdom, there is a mile of railway to every six miles of area, and every 2000 inhabitants; and if we take the United States, Europe, and the British colonies together, we find one mile of railway to every 57.5 square miles of area, and every 2467 inhabitants.

In considering the extent of railway facilities actually necessary to each colony, its natural resources must be duly estimated and allowed for. It is impossible that we can furnish a standard of adequate colonial railroad service based on European *data*, the circumstances of our colonies being as unlike as possible to those of Great Britain, or indeed any of the Continental nations, in respect both to area and to population.

If we apply the test of area alone, the imagination almost refuses to grapple with the figures that describe the resources of our possessions abroad. The area of the British islands is about 75 millions of acres, of which 50 millions are cultivated or cultivable. The area of our Australian empire is 1968 millions of acres, the greater part of which is believed to be capable of yielding excellent crops, alike of cereals and of tubers. In the Canadian North-West alone, there are 384 million acres of valuable agricultural land, the whole of which is admirably adapted for settlement and cultivation. In British India, again, there are close on 600 million acres of land under cultivation, or capable of being cultivated, and much of it, under judicious irrigation, may be made to yield two, and

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even three, crops in a year. These are the territories that are, or that we would wish to see become, the wheat-fields, the grazing lands, the orchards, and the market-gardens of the mother-country.

The problem that our own people have got to face, and which, sooner or later, is certain to press for solution, is something like this: England is now, and has for a number of years been, increasingly dependent upon importations of food from abroad. According to Sir James Caird's calculations, we imported in 1880 foreign food supplies of the value of 125 millions sterling, being roughly an average of rather over £4 per head for the whole population of Great Britain. Of this large item the United States are now supplying us with 28 to 30 millions worth per annum, or about 25 per cent. of the whole. But the United States are, in fiscal affairs, a hostile country, endeavouring as far as possible to exclude British produce by unfriendly tariffs. On the other hand, we have an empire of our own, outside the limits of these islands, that has an area of over 8 millions of square miles, and a population of nearly 300 millions—an empire that is not only ready, but eager, to trade with us in the most friendly manner, that possesses an enormous wealth of virgin soil, an enterprising and industrious, if still somewhat sparse, population, and every necessary resource for meeting our requirements as regards food supplies, excepting only the means of bringing those supplies from their wheat-fields and grazing lands to the doors of the great consuming public within our own islands. Not only so, but our Australian colonies and the great North-West of Canada possess, as regards certain cereals, a more fertile soil even than the United States of America. In the latter country, European methods of husbandry have now largely become necessary, in order to meet the requirements of a more or less exhausted soil; but in the Dominion and in Australasia there are still millions of acres that have never been scratched with spade or plough, and whence we may fairly expect in the

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future to draw a large proportion of our outside food requirements. The question is now, therefore, presented, How much longer shall we continue to withhold from our own colonies the thirty millions sterling, or more, which we have now for many years annually paid to the United States for wheat and butcher meat? The obvious answer to such a problem is, that we shall do so just as long as, and no longer than, the railway communication of our colonies remains inadequate and incomplete. If Canada and India had to-day solved the railway problem as effectually as the United States have long since done—if railway facilities were as abundant between the producers and the ports, and if the rates of freight were as cheap, and as entirely adapted to the development of the trade, there would be no need for the dependence upon American supplies that now exists. It is not necessary that we should resort to any heroic remedies. No retaliatory fiscal duties, no protection, no reciprocity, no fair-trade nostrums are called for. The problem will solve itself by the operation of natural laws—by the capacity that the Anglo-Saxon race have ever manifested for adapting means to ends, and especially for ends that are so important to their commercial well-being as the acquisition of the home markets.

It is important to remember that the average cereal crops of the United States have not within recent years been so large as formerly.[1] Whether this is due to the increased depletion of the soil, or to the

[1] The averages of four-yearly periods have been calculated from the Statistical Abstracts of the United States to be as follows :—

Items.	Average Yield per Acre in Bushels.	
	1862–65.	1880–84.
Corn	30.2	22.9
Wheat	13.4	12.0
Buckwheat . . .	18.4	11.5
Rye	15.0	12.3

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bringing under cultivation of less prolific tracts of land, or to less genial seasons, or to these and other causes combined, we need not now inquire. But, whatever the cause, the effect upon the chances and opportunities of the colonies, in reference to the home markets, can scarcely fail to be salutary. The strides that the colonies have already made in the direction of furnishing the mother-country with bread-stuffs are such as put even the fabled achievements of the seven-league-boots entirely in the shade. Between 1868 and 1882, the imports of wheat into Great Britain increased from 798,000 to 3,115,000 cwt. as regards the Dominion, from 161,000 to 8,463,000 cwt. as regards British India, and from 327,000 to a maximum of 4,613,000, in 1880, as regards Australasia. The question of whether our own colonies can compete with the United States and Russia in supplying the food requirements of the mother-country may be regarded as settled by these figures. But even supposing that it were not, it is clearly the interest and the duty of the mother-country to endeavour, by every possible means, to solve it in favour of the colonies, whose chief want now, and for years past, has been the lack of adequate transportation facilities.

The United States supply a notable example of what may be done for a country that is endowed with good natural resources, by the aid of ample means of transportation, and of how such facilities tend, both to the great increase of trade, and the cheapening of the cost of bringing together the two classes into which, for railway purposes, all mankind may be said to be divided, viz., producers and consumers.

Again, the development of the foreign trade of the United States has been greatly helped by the low rates of freight which the greatly increased volume of traffic at command has enabled the railway companies to concede. This is a point of the utmost importance in considering the means of colonial development. Between 1870 and 1884, the railways of the United States had reduced their

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freight rates by fully one-half over the whole of the enormous traffic which they carry.[1] In relation to this fact, we have shown in the previous chapter that, if the same average rates of freight prevailed at the present time as in 1870, the agriculturists and traders of the United States would have been paying a hundred million pounds sterling more than they actually are for railway transportation. Again, the stimulating effect of railway facilities upon the trade and commerce of a country has within recent years received a very remarkable illustration from the experience of our Indian empire. To go no farther back than 1880, it appears that the railways of India carried in that year less than 10½ millions of tons of goods and minerals, whereas in the year 1884, the quantity carried had advanced to over 16½ millions of tons. In the interval, therefore, there had been an increase of 6 millions of tons, or 60 per cent., as compared with an increase of 1928 miles, or 22 per cent., in the extent of railways opened for traffic. It is a striking feature of the Indian railways, that not only have they always brought traffic with them, but the extent of that traffic has invariably exceeded the official estimates framed when the lines were projected. The railways have exercised an equally marked influence in assisting the development of the foreign trade of India. Between 1868 and 1884, the exports of British India rose from 50¾ to 88 millions, while the imports increased from 35½ to 52¾ millions, and in India, as in the case of the United States, the increase of volume, taking the lower range of prices into account, has been much greater than the increase of value.

The colonies and the United States have many things in common, but in nothing are they more alike than in the fact that agricultural produce, in one form or another, is the staple of their railway traffic. In 1880, the railways

[1] The total number of tons moved in 1883 was 400½ million tons, and the receipts therefrom amounted to 544½ millions of dollars. The average rate received over the whole was .64d. per ton per mile.

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of the United States carried over 70 millions of tons of agricultural produce, out of a total traffic of 290 millions of tons, being close upon 30 per cent. of the whole freight carried. On the transport of this traffic from the place of production to the ports, the agriculturists of the United States are now paying about 30 millions sterling a year less than they would have required to pay at the rates of twelve years ago. As a result of this remarkable reduction in the cost of transportation, the agricultural exports of America have, since 1870, been more than doubled in value, and greatly more than doubled in volume. To our colonial possessions, these are facts pregnant with significance, proving, as they do, that if the maximum amount of development is to be attained in commercial and agricultural affairs, it is not enough to provide railway facilities, but they must be furnished at the lowest possible price. The reduction of American railway rates has been the controlling factor, not only in regard to British imports of food supplies, but in the character and extent of British, and even European, agricultural depression.

It is not unusual to hear it claimed that this or that country or community is so amply endowed with all the essential requirements of civilised existence—that it has such a wealth of both agricultural and other resources—as to be entirely independent of external commerce. It is not uncommon to find the United States quoted as an example of a country thus situated; and probably, if it may be claimed for any nation that it has every resource within its own borders, that claim may be made on behalf of the North American Continent. And yet, as we have seen, the United States have developed an enormous *export* trade, which has entailed, and brought in its train, whether they liked it or not, and even in spite of their utmost efforts to the contrary, a corresponding development of *imports*. Now, our colonies, almost without exception, have an enormous surplus of produce to dispose of. In the meantime that surplus is mainly agricultural.

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By-and-by it will take other forms as well, and we may expect before long to draw from our colonial possessions, the great bulk of the raw materials of our widely-ramified manufacturing industry. But we may depend upon it, that the import of commodities will follow their export, and that the more the colonies send to us, the more we shall send to them.

It is, therefore, a matter of vital concern to British colonial possessions, and not less so to the mother-country, that they should be furnished as speedily as possible, and on the greatest attainable scale, with the means of transporting their produce from their wheat-fields and their vineyards, their sheep-runs and their cattle ranches, to the markets of Europe. Need we add that without railways, the most prolific soil in the world will fail to yield the best return—that is to say, the price of commodities is generally determined by the facility and the cost with which they can be put upon the principal markets; and if railway communication is established throughout the colonial possessions, the prices of wheat, beef, mutton, and other produce grown for export, will be affected, not by merely local considerations, but by the quotations ruling in Mark Lane and Smithfield, plus the cost of reaching those markets.

Having thus considered some of the more general economic conditions of the problem, the special circumstances of colonial railways remain to be dealt with.

There have been many different methods of financing the railways constructed in the colonies. Each has adopted the means that appeared best suited to its special circumstances. Some have sought to provide the "sinews of war" by a variety of processes; but in all cases alike, the development of the railway system has been limited from the outset by the exigencies of finance. This is, indeed, the crux of the whole matter. It is not to be expected that a benevolent public will come forward and subscribe the capital requisite to build railways, with a prospect of only

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receiving 2 to 3 per cent., in countries where the ruling rate of interest is double these figures. Nor is it a common experience that the public subscribe largely to newly-projected colonial railways, even when they have exceptionally good prospects before them, since railway traffic takes a certain time to develop, and investors are not content to wait for distant or hypothetical results.

In order, therefore, to furnish the capital necessary for the railways already built, the colonies have been compelled—

(1.) To obtain Government guarantees, as in India.

(2.) To obtain direct State and municipal aid, as in Canada.

(3.) To raise loans on European markets, as in the cases of the Australian colonies, and the Cape of Good Hope.

These three principal modes of procedure have been varied, according to the special circumstances of each country or colony. In some cases, the Government has constructed a certain proportion of the mileage of a great trunk line, as in the case of the Canadian Pacific.[1] In other cases, the aid furnished by the State has been limited to land grants. In other cases, again, both Imperial and municipal funds have been provided for the construction of railways of urgent necessity. As regards India, there are three systems of financing adopted—the first, that of the Bengal and North-Western terms, whereby the railways are constructed entirely by a private company; the second, that of the Bengal Central terms, under which the State guarantees 4 per cent. on paid-up capital during construction; and the third, that of the Southern Mahratta terms, which provide for the company receiving a guarantee of $3\frac{1}{2}$ per cent., plus one-fourth of the net receipts, during the period of their concession or agency. In the case of

[1] In this case, the Dominion Government constructed and transferred to the company free of cost 7.14 miles of road, out of a total of 3268 miles, in addition to donating 25 millions of acres of land, and granting a subsidy of 25 millions of dollars as a loan.

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Australian and Cape Colony lines, the necessary capital has been raised by loans on the London money markets and by Government grants.

One remarkable feature of the railway finance of the more important colonies is the ready acquiescence of the inhabitants to tax themselves for transportation facilities. Thus, we find that while the total expenditure incurred on Canadian railways, up to the end of the financial year ending June 30th, 1884, was 557 millions of dollars, the several Governments and municipalities had contributed 187 millions of dollars, or about 34 per cent. of the total. Of this proportion, the Dominion Government furnished 150 millions, and the Quebec Government over 14½ millions, while the municipalities, as such, contributed over 14 millions in all. In the Australian colonies, the same feature is characteristic of railway finance; and it must be a source of satisfaction to these colonies to reflect that they are thus providing for posterity a heritage that will improve as years roll on, and which will enable them, at an early stage of their career, to dispense with that crushing burden of taxation, which dynastic and other wars have entailed upon European countries, without any similar set-off or compensation.

One point that is of considerable importance, in reference to the construction of colonial and Indian railways, is the rate of interest at which capital can be raised. In most cases of money being guaranteed or loaned for railway extension, the rate of interest has been higher than it should be, having regard to the generally profitable and safe character of the investment. Thus, we find that of 97 millions raised by the various guaranteed railway companies of India in 1879, about 83 millions were share capital raised at 5 per cent. At the end of 1883, this sum had been reduced to 56¾ millions by a rearrangement of the capital expenditure; but in both cases the rate was much higher than it should have been, having regard to the fact that the interest is paid in London in

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sterling. In the case of Canada, the rate of interest would naturally be expected to be higher, but it is not, perhaps, so much so as most financial experts would look for, the rate varying only between 6 and 5 per cent. on the paid-up bonded debt of 109 millions of dollars. In the Australian colonies, the value of credit as an asset is being increasingly realised. New South Wales, which had until lately to pay 5 per cent. on railway loans, has just borrowed 5½ millions at 3½ per cent. for railway purposes, which is about ¾ per cent. less than the average rate of interest paid on railway loans in Great Britain.

There has, necessarily, been a great diversity of experience in regard to the cost of constructing Colonial railways, as might be expected from the varied character and cost of the elements that enter into such expenditure. In very few cases has land been an item of cost of any importance; it has generally been given free throughout Australia, Canada, and British India. In this respect, therefore, the Colonial railways differ widely from those of older countries, and especially the mother-country, where the land has been estimated to have involved an average expenditure of £4000 per mile. The principal items of outlay for Colonial lines are generally permanent way and rolling stock.

These facts and considerations suggest whether it may not be advisable, in the case of new and sparsely populated countries, to endeavour to economise first cost by one or other of the several expedients that are so well known to railway promoters and engineers. In some countries, narrow-gauge railways have been found to fulfil this condition, although the break of gauge is not to be recommended where it can possibly be avoided. In India, there were, in 1884, 10,737 miles of railway constructed, of which 7314 miles were built on the broad, and 3255 miles on the metre, gauge.[1] The cost of the former amounted to an

[1] There were also 27¼ miles on the 4 feet gauge, 91 miles on a 2 feet 6 inches gauge, and 50 miles on a 2 feet gauge.

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average of £16,772 per mile, while the latter only cost £6895, the average cost per mile for the whole country being £13,611. Again, in Canada, it has been deemed advisable, with a view to furnishing transportation facilities to districts that would not otherwise, in all probability, have acquired them so soon, to construct some hundreds of miles of narrow-gauge railways, in the back country beyond Toronto, which have cost an average of only £4020 per mile, as compared with an average expenditure of about £8000 per mile for broad-gauge railways in the same province. In this case, the narrow-gauge railways, with an average net income of £113 per mile, have yielded 4 per cent. on the cost of construction, whereas the broad-gauge railways, with an average net income of £250 per mile, have only yielded 3 per cent. on their capital cost.[1]

There are, however, those who distinctly maintain that the narrow-gauge railways are less satisfactory than their rivals—that the cost of working them is relatively higher, that their capacity is much less, and that there is a heavier expense incurred for maintenance. These considerations were strongly urged before the Select Committee on Indian Railways in 1883–84.[2] On the other hand, some authorities held that the metre-gauge should be used as feeders for main lines, and that the narrow-gauge is equal to carrying any traffic that it is likely to be called upon to bear.

On the Canadian narrow-gauge railways, the results obtained appear to have been very satisfactory. The net income per train-mile is stated at 40.16 cents for the broad, and 38.10 cents for the narrow, gauge, while the working expenses per train-mile are given as 69.44 cents for the broad, and 58.64 cents for the narrow, gauge.[3]

[1] *Minutes of Proceedings of the Institute of Civil Engineers*, vol. xlviii., p. 256.

[2] *Vide* "Report," pp. 1684–87, 1739–46.

[3] *Minutes of Proceedings of the Institute of Civil Engineers*, vol. xlviii., p. 256.

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Figures like these, however, do not wholly settle the question. There are many other problems involved in the matter of gauge which are not to be solved by any one factor of cost. The opinion of the Select Committee of 1884 on Indian Railways was that the metre or narrow gauge should, as a rule, "be confined to tracts of country where that system is already in successful operation, and to local lines where the traffic is likely to be so light that cheapness of construction more than counterbalances the undoubted disadvantage of break of gauge." It is probable that this recommendation is, on the whole, a wise one. It is certain that, on the great majority of lines, the ultimate traffic has largely exceeded the most sanguine expectations of promoters and builders. We are now using 40 to 50 ton engines, where 7 to 10 tons were deemed sufficient not so many years ago. In some cases, 90-lb. rails are being used where 56 and 72 lbs. were regarded as adequate within recent memory. And so with all the other conditions of railway working.

In considering the subject of railway development in the British possessions abroad, one of the first points that arrest attention is the manifest difficulty of framing suggestions that will equally apply to the great diversity of conditions and circumstances that have to be taken into account. We have, at the one end of the scale, British India, with her teeming population of over 200 millions to an area of less than a million square miles, and at the other, Western Australia, with a population of only 30,000 to approximately the same area. Between these two sets of circumstances there is a great gulf fixed, and where the conditions to be met are so varied and complex, there must needs be variety in the means of meeting them.

Again, there is a very remarkable disparity between Indian and Colonial, and especially Australian, railways, in reference to the cost of working. In the one case there is the cheapest, and in the other perhaps the dearest,

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labour in the world, as measured by the sum of money paid for a day's work. It is necessary to bear this qualification in mind, since it may easily, and, in point of fact, often does, happen that the highest-paid labour is the more economical in the long run.

The cost of working Indian railways is much under that of working European or Colonial railways in general, and this explains, to some extent, the exceptionally low rate of tariff charges that obtains thereon. Mr. Rendel has shown that the average sum received for carrying a passenger one mile on the Indian State railways is .336d., while the cost of the service is .174d., leaving a profit on the transaction of .162d. For carrying a ton of goods traffic one mile the average receipts amounted to .986d., and the average cost of the service to .420d., leaving a profit of .566d., or more than 130 per cent. on the cost incurred.[1] In Canada the freight rates also take an exceptionally low range. This is the result, in great part, of the competition that exists between the principal Canadian lines, and especially the Grand Trunk and the Canadian Pacific, for the trans-Continental traffic. On a great part of the traffic moved on these lines, the average ton-mile receipts are under a halfpenny, or about one-half the average ton-mile receipts from goods traffic in this country.

It is a rule with some engineers that the cost of a railway should not exceed ten times the amount of its gross annual revenue. Measured by this rough-and-ready test, our Colonial railways are found somewhat wanting. This is particularly the case in Canada, where the sum actually expended has been 125 millions, against the sum of 67 millions, represented by ten times the gross annual receipts. In India, on the contrary, the theoretical limit of expenditure is 163 millions, or 20 millions more than the actual outlay. Taking our eight principal Colonies together, the sum actually expended in railway construction has been 347 millions sterling, or 46 millions more than the theo-

[1] Report on the Railways of India for 1877-78.

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retical limit; but this, after all, is no worse than the case of the railways of the mother-country, which, at the end of 1883, had cost 785 millions, against a theoretical limit of 682 millions, being 103 millions more than the figure at which they ought to stand. In the United States and in Germany, the actual cost of the railways built has been under the theoretical limit, while in France and Belgium the railways have cost slightly more. It is somewhat remarkable, however, that if we take the United States, Germany, France, and Belgium together, their railways had actually cost 2590 millions to the end of 1883, against a theoretical limit of 2603 millions, so that the two items were practically identical.

The general principles that guide and control economical railway working are sufficiently well known to railway authorities, and need not be dealt with here at any length. One of the most important is that of securing a high range of gross earnings per train-mile, or, in other words, running full train-loads. Another is that of keeping the working expenditure low, relatively to the gross receipts. It is maintained by some authorities that the former should never be under 5s. per train-mile, and by others that the latter should never exceed one-half, or 50 per cent., of the total gross earnings.

In the case of the United Kingdom, the average earnings per train-mile are much below those of most other countries, chiefly because of inattention to the rule of running full train-loads. Over the last thirty years the maximum earnings per train-mile on British railways reached 5s. 11¼d. in 1856, while the minimum amounted to 5s. in 1884.[1] The earnings have, therefore, varied within comparatively narrow limits, but with a tendency towards a lower rather than a higher level.

On our Colonial railways, with the exception of Canada, the average range of ton-mile earnings are higher than in the mother-country, but still below the average of some

[1] Since this was written the average train-mile receipts have fallen to 4s. 10d. for 1885.

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Continental countries. The highest train-mile receipts are obtained in India, where they amounted in 1884 to about 8s. 9d. Cape Colony came very nearly up to the same average, with 8s. per train-mile. In the Australasian colonies, the average train-mile receipts varied from a minimum of 6.2s. in the case of Queensland, to a maximum of 6.7s. in the case of New Zealand; but in all cases the average was higher than in the mother-country. It is, however, to be observed that, except in India and Canada, the average transportation rates are higher than in Europe, and much higher than in the United States, where the average receipts per train-mile amounted, in 1883, to 6.2s. for goods, and 6.7s. for passenger traffic. It is, of course, a moot point how far a high train-mile rate is compatible with affording the most ample facilities for traffic, and it is not fair to forget that the superior facilities, as regards the number and the despatch of trains, afforded in England, have much to do with the lower train-mile rates on English railways; but in newer countries, where the traffic is not so liable to congestion, this is clearly a matter of less importance.

The average gross and net earnings, and working expenditure, per train-mile, are shown, for the several leading colonies, below:—

Statement showing the Average Gross Earnings, Working Expenses, and Net Receipts per Train-Mile in Different Colonies in 1884.

Colonies.	Gross Earnings.	Working Expenses.	Net Receipts.
	d.	*d.*	*d.*
India[1]	96.80	48.82	47.98
Canada[2]	56.15	43.40	12.75
Cape Colony	96.00	63.30	33.70
Victoria	79.91	53.62	26.29
New South Wales . . .	78.07	47.61	30.46
New Zealand	81.19	55.40	25.79
Queensland	74.68	39.14	35.54
South Australia	77.16	51.55	25.61

[1] The rupee has been converted into sterling at its nominal value of 2s.
[2] The dollar has been converted at its nominal value of 100 cents, or 4s. 2d.

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The working expenditure of a railway system is necessarily affected by economic conditions that are always more or less local in their application, such as the cost of labour, the price of fuel, and the relative cheapness or dearness of materials. The proportion of the gross receipts of a railway that is absorbed in working it, depends partly on these factors, and partly on the extent of the traffic carried. It is manifest that there may be an absolutely high range of train-mile receipts, and yet a very low range of net receipts, in cases where the traffic to be carried is exceptionally limited; so that, to produce a relatively low working cost and a relatively high net income, there must be a conjunction of favourable economic conditions, as regards the cost of working and density of traffic. With the exception of India, all the British colonies of any considerable importance have not yet attained these favourable conditions to the fullest extent. They have to contend with higher-priced labour and materials, and a much lower relative volume of traffic, than obtain in Europe, and hence they require to expend a larger proportion of their gross earnings in the working of their railway systems.

The following figures show the proportions of the gross receipts expended in working the railways of different colonies it 1883–1884:—

	Per Cent. of Gross Receipts.
India	37.62
Cape Colony	64.80
Canada	76.50
Victoria	67.11
New South Wales	60.98
New Zealand	68.24
Queensland	52.41
South Australia	66.81

In only two cases—those of India and Queensland—is the percentage of working expenditure under that of the United Kingdom, where this factor has varied from a minimum of 47 to a maximum of 55 per cent., over the

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last thirty years. In the United States, which possess the greatest volume of railway traffic of any country in the world, the working expenses absorbed, in 1883, 63.8 per cent. of the gross receipts. With the exception of Canada, therefore, our colonies cannot be regarded as greatly transgressing the essentials of economical and successful working in this regard.

In view of the importance of making every possible effort to extend Colonial railways, and so accelerate the development of the resources of "England beyond the sea," it is interesting to consider what are the limitations imposed upon the prospects of railways as investments by the extent of traffic available. For this purpose I have compiled a table which shows, as regards eight of our principal colonies, including India and Canada, the absolute gross and net earnings, the net earnings per mile, and the percentage of net earnings on capital cost. The main results brought out by this compilation are, that the net earnings vary from a minimum of £163.4 in the case of Canada, to a maximum of £804.2 in the case of India, per mile of line open. Queensland, with an average net income of only £268.4 per mile, succeeded in returning an average dividend of 4.04 per cent., and South Australia, with an average net income of £178.6 per mile, paid 2.77 per cent.; while New South Wales, with an average income of £485.1 per mile, yielded an average return of 4.20 per cent. In the case of English railways, it requires a net return of over £1770 per mile, or more than six times the avearge net earnings of the Queensland railways, to pay approximately the same rate of dividend—the average for the United Kingdom having been 4.16 per cent., as against 4.04 in Queensland. These figures sufficiently show that Colonial railway property is a very different thing from English, and that the two must not be tested by the same criteria. The details are appended herewith:—

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Statement showing the Gross and Net Earnings, the Net Earnings per Mile, and the Percentage of Net Earnings on Capital Invested in Colonial Railways, in 1884.

Colonies.	Miles Open.	Gross Earnings, £1=1000.	Net Earnings, £1=1000.	Net Earnings per Mile.	Percentage of Net Earnings on Capital Cost.
India	10,447	£16,279	£8,401	£804.2	5.91
Canada	9,575	6,680	1,565	163.4	1.4
Cape Colony . . .	1,344	965	338	251.5	2.65
Victoria	1,562	1,898	624	399.5	2.91
New South Wales . .	1,618	2,086	785	485.1	4.20
New Zealand . . .	1,396	961	305	218.5	2.51
Queensland . . .	1,207	682	324	268.4	4.04
South Australia . .	1,036	557	185	178.6	2.77
Totals and average .	28,185	£30,108	£12,527	£444.5	—

In Colonial railway construction, it is manifestly of importance, where the traffic has to be created, and the resources of capital are limited, to keep down expenditure as much as possible. This is not, however, always an easy matter, especially when the engineers are wedded, as so many are, to English rules and practice, and believe in solidity of construction rather than the opening up of as great a stretch of country as possible. The average cost of the railways built in our nine principal colonies, including India and Canada, amounted at the end of 1883 to £11,913 per mile, as compared with about £50,000 per mile expended on British railways, and £12,000 per mile expended on the construction and equipment of the railways of the United States. The lowest average cost has been incurred in South Australia and Queensland, and the highest in Victoria and India, as the following table shows:—

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Statement showing the Mileage of Railways Constructed to the end of 1884 *in the Principal Colonial Possessions of Great Britain, with the Total Capital Cost, and the Average Cost per Mile.*

Colonies.	Miles Constructed.	Total Cost £1=1000.	Average Cost per Mile.
Australasia—			
Victoria	1,562	£21,488	£13,757
New South Wales . . .	1,321	16,915	12,810
New Zealand	1,396	12,163	8,713
Queensland	1,207	8,031	6,654
South Australia . . .	1,036	6,664	6,432
Tasmania	215	1,793	8,340
India	10,832	143,000	13,202
Canada	10,243	125,200	12,223
Cape Colony	1,453	13,392	9,217
Totals and average .	29,265	£348,646	£11,913

It is not, however, always within the power of an engineer to determine the cost at which a railway shall be made. If the alignment and gradients are easy, the number of bridges and viaducts few, and the price of the land nominal or *nil*, the cost of construction will necessarily be much less, even with the same gauge and weight of rails, &c., than in cases where the opposite conditions prevail. Then, again, the cost of equipment must be proportioned to the extent and character of the traffic. If the traffic is light, so also will, or should be, the cost of the rolling stock. A rule frequently adopted by railway engineers is, that the cost of the rolling stock should represent the equivalent of a year's gross earnings. On this basis, India should have fully twice the rolling stock for the same mileage as Canada, since the gross earnings of Indian railways are double those of Canada per mile of line open.

Once more it will be obvious that the effect of building railways that are too light for the character of the traffic will be to greatly increase the cost of working, or rather

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the expenses of keeping up the lines, so that the possible economy in first cost would be neutralised by the increased expense of maintenance. It is difficult to lay down a hard-and-fast rule on this point, since the traffic of to-day may be doubled, trebled, or even quadrupled in a few years' time, on the same lines, and hence the conditions to be met in the near future may be entirely different. Such has, indeed, been the experience of the United States and other countries, where a much more substantial roadway has been entailed by the growth of traffic. In each separate case, therefore, the promoters of a new line should consider, not only the traffic already existing, but the traffic that is likely to be created; and this can only be measured by a due regard to the resources and population of the district through which the railway is to be carried. In all cases, the traffic is likely to increase from year to year, but its development must take a much longer period in some cases than in others. It is inevitable that in a country like India, with a population of nearly 20,000 per mile of railway constructed, the traffic should grow more quickly than in a country like Canada, where there are only 470 to the mile. In practice, however, it is found that even to this rule there are limitations. The extent of goods traffic is not always a function of extent of population. This is sufficiently proved by the fact that in India, in 1883, the total tonnage moved on 9510 miles of railway was less than the tonnage moved in Canada on 7530 miles of railway, although the population of Canada in that year was only $\frac{1}{60}$th of that of our Indian empire. In other words, there were 3 tons moved for every inhabitant in Canada, as against 0.05 ton per inhabitant in India.

The necessities imposed upon them by the character of their traffic, and the competition which very generally obtains, have caused English railways to be worked much less economically than those of some other countries. In the colonies, however, those necessities scarcely exist as

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yet, since the railway system has not been developed sufficiently to induce any competition worth speaking of. Hence, according to Mr. Rendel, the East Indian line, with a traffic equal to that on the London and North-Western, is able to carry both passengers and goods at about one-third of the North-Western cost. The secret of this superior economy in India is, that there are few trains run, and those trains are very full. As a result, the locomotive stock of the East Indian line is only about 600 engines, while the London and North-Western has three times as many, and the wagon stock of the East Indian is not more than one-fifth that of the London and North-Western line. Mr. Rendel has calculated that on the East Indian line the number of passengers in a train averages 260 or 270, as against about 50 on the London and North-Western, while the number of tons to a goods train will average 164, taking empty and full together, as against 70 on the London and North-Western.

The construction of a railway may be regarded, in a general way, as calculated to open up a country to the extent of about twenty miles on either side. Beyond that distance, the cost of wagon transport becomes so high as to shut out agriculturists and manufacturers from competition with those who are within the twenty mile limit. If, then, we assume that the beneficial operation of railway facilities is bounded by this area, we shall find that, while the railways built in the United States would be equal to the opening up of about 5½ millions of square miles, or nearly twice the whole area of the country, excluding Alaska, the railways so far built in Canada are only equal to opening up about 400,000 square miles, or very little more than one-ninth part of the whole, while the railways constructed in India only provide for opening up about half a million square miles, or rather more than one-third of the total area of the country. With regard to the Australasian colonies, the case is even worse, since the railways constructed, up to the present time, amounting

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to 7000 miles in all, are only calculated to provide facilities for 280,000 square miles, or $\frac{1}{11}$th of the whole area of the country.

It is a disputed point how far railway facilities contribute directly to the wealth and commerce of a country. But there cannot be any possible doubt as to the beneficial effect of railways in improving the value of land in new countries, that grow produce for purposes of export. Of this fact the United States supply a remarkable example. A recent writer says of Oregon, "that thirteen years ago, it hardly exported any wheat to Europe, for lack of cheap transportation to the ship. The nominal price of farm land was then from 5 to 10 dollars per acre, but since railroads have been built, the value of improved agricultural land has risen to from 10 to 100 dollars per acre." The total area of the British colonies, including India, may be put down roughly at 8 millions of square miles, or 5120 millions of acres. If we were to allow ourselves to be persuaded that the ultimate effect of railway facilities would be to increase the value of this immense area by an average of only one shilling an acre, it would seem to follow that the Colonial landowners would thus be benefited to the extent of 256 millions sterling.

The effect of railway development upon national trade and commerce, although perfectly obvious and appreciable, is not any more capable of being expressed in exact figures. The high economic authority of Mr. Gladstone has been given to the estimate, that out of a total increase of 162 millions in the exports of the United Kingdom, between 1830 and 1879, 50 millions may fairly be credited to locomotive agencies, and 112 to liberating legislation,[1] or, in other words, only 30 per cent. of the whole is attributable to railway facilities. This is necessarily an arbitrary figure, but Mr. Gladstone gives reasonable, if not entirely adequate, grounds for his hypothesis; and if railways have added 50 millions a year to the value of the export trade

[1] *Nineteenth Century*, February 1880, p. 386.

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of our own country, it is to be expected that they will exercise a similar influence in reference to the trade of other countries that have any considerable bulk of produce to export, and especially of such countries as the majority of the Colonial possessions, in which the agricultural surplus available for export is very large.

There cannot be any doubt that it is the interest of a colony, both immediately and remotely, to make every effort to promote the extension of its railway facilities. For this purpose, it may safely venture to incur a debt that would not be justified for any other purpose. Not only so, but that justification would extend to the payment, if needs be, of a higher than the normal rate of interest on loans borrowed exclusively for productive works. Search where we may, and in countries that have anything like the semblance of vitality, the effect of railways is the development of traffic and commerce. Throughout our Colonial empire, there are resources sufficiently ample and elastic to justify the view that this development will be rapid, and all but illimitable. But, taking the colonies so far as we have the *data* at command, we have as yet only one mile of railway to every 269 miles of territory, whereas the average of the United Kingdom is 6.4 miles of area, and that of the United States 25.0 miles, to every mile of railway. Is it quite beyond the bounds of possibility that our colonies may yet come up to the standard of the United States? If that should ultimately be attained, our Colonial railway mileage will not be the paltry 29,178 miles at which it now stands, but 320,000 miles, or about eleven times as much. Population and capital appear to be the only desiderata necessary to this result, and these, we may depend upon it, will ultimately be forthcoming. Meanwhile, the colony that succeeds (by taxing itself, by mortgaging the future, or by any other means) in constructing the greatest railway mileage, relatively to its area and population, is likely to have the best start in the race

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that our colonies must hereafter engage in for supremacy at home and commercial intercourse abroad.

APPENDIX.

The two tables that follow are designed to illustrate some of the preceding remarks, and especially to show the remarkable differences that distinguish the several Colonial dependencies of Great Britain in reference to the relation of railway facilities to area and population :—

Statement showing the Area of British Possessions Abroad, and the Mileage of Railways Constructed in 1882–83.

British Possessions.	Square Miles.	Mileage of Railways Constructed in 1882.	Average Area to each Mile of Railway.
British India	904,135	10,832	83
Ceylon	24,702	178	139
Cape of Good Hope . .	221,950	1,453	153
Canada	3,510,592	9,575	367
Jamaica	4,193	25	168
Trinidad	1,754	58	30
British Guiana . . .	76,000	51	1,490
Mauritius	713	110	6
Australasia—			
New South Wales . .	310,700	1,365	228
Victoria	88,198	1,562	56
South Australia . . .	903,690	1,036	872
Western Australia . .	1,000,000	115	8,696
Tasmania	26,215	215	122
New Zealand . . .	105,342	1,396	75
Queensland . . .	669,520	1,207	555
Totals and average .	7,847,704	29,178	269

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Statement showing the Population of the British Colonies in 1881, *and the Mileage of Railway Constructed in* 1882–83.

Colonies.	Population in 1881.	Mileage of Railways Constructed.	Population to each Mile of Railway.
British India . . .	202,694,981	10,832	18,713
Ceylon	2,758,529	178	15,497
Cape of Good Hope . .	1,249,824	1,453	860
Canada	4,504,319	9,575	470
Jamaica	580,804	25	23,232
Trinidad	153,128	58	2,640
British Guiana . . .	252,186	51	4,945
Mauritius . . .	377,373	110	3,431
Australasia—			
New South Wales . .	751,468	1,365	551
Victoria . . .	862,346	1,562	552
South Australia . .	279,865	1,036	270
Western Australia .	29,708	115	258
Tasmania . . .	115,705	215	538
New Zealand . .	489,933	1,396	351
Queensland . . .	213,525	1,207	177
Totals and average .	215,313,694	29,178	7,379

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CHAPTER XXIII.

ENGLISH RAILWAY ADMINISTRATION.[1]

THERE is no material interest that is of greater present and ultimate importance, in relation to the comfort, convenience, prosperity, and general well-being of a nation, than its railway system. If that system is adequate in its resources, and efficiently administered, it is certain to be a main factor in assisting a country to achieve and to maintain a foremost place in the family of nations. If, however, the reverse conditions are in operation, no country can hope to fill that place in the world's economy to which it might otherwise attain.

Regarded from this point of view, it is a matter of some importance to consider how far England is before or behind other, and especially industrially and commercially competitive, nations, in reference to its means of internal transport and intercommunication.

English railways have a number of characteristics that distinguish them from those of other countries in a more or less considerable degree. The more prominent of these characteristics are an enormously high capital expenditure; high rates of speed, and consequently quick transport and delivery; a very large passenger traffic, relatively to area and to population; an exceptionally high range of rates and fares, &c. These phenomena are all more or less inter-related. The high capital expenditure compels a higher range of rates and fares in order to yield the

[1] This chapter is largely made up of a paper which the author read at the Birmingham meeting of the British Association in 1886.

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same result on the same volume of traffic. The higher rates of speed that are characteristic of English railways tend to a higher average cost of transport; and the quickness of despatch and delivery that English lines excel in compels the running of wagons and trains that are not so fully loaded as the average of other countries, and which, accordingly, fail to show an equally high range of train-mile receipts and net profits on the same volume of business, as if the Continental or American methods were more generally pursued.

England, as the pioneer of railway development, has had to pay very dearly for her experience. We have had to pay an infinitely higher price for land than any other country, and we have constructed heavy embankments and tunnels to secure as direct routes as possible, where these would, in other countries, have been avoided by curves and steeper gradients. Then, again, English railways have been constructed to stand a heavier traffic and a larger amount of wear and tear than the railways of any other country. The permanent way is heavier, there is a larger proportion of double line and siding accommodation, and, finally, the expenses of the Parliamentary contests in which English companies have been involved have added enormously to capital cost, while millions have been dissipated in endeavouring to raise the necessary capital for lines that never have, and possibly never will, realise either the promises or the expectations of their speculative promoters.

But manifestly these considerations apply almost exclusively to newly-constructed lines. They do not account for the increase of capital expenditure on already existing lines. That increase has within recent years been so serious as to deserve a much greater share of public attention than it has hitherto received. If we take the country as a whole, we find that the average capital expenditure, per mile of line open, rose from £35,984 in 1872 to £42,561 in 1885. In the interval, the mileage of lines

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open had been increased by 3355 miles, and the capital expenditure by about 247 millions; so that the average capital per mile of new line would come out as more than £73,000, if the whole additions to capital had been devoted to that purpose. Between 1862 and 1872 the increase of line opened was 4263 miles, and the increase of capital expenditure was about 184 millions, representing an average of rather over £43,000 per mile of new line. What has become of the enormous difference in the capital expenditure, as tested by the standard of new mileage opened, during the later of the two periods? This difference is equal to not less than £30,000 per mile of new line, and its effect has been, as already stated, to bring up the average capital cost of our railways, as between 1872 and 1885, by £6577 per mile of line open. The increase has been most marked in the case of the English and Welsh lines. In 1872 these lines represented an average capital of £42,500 per mile open. In 1885 the capital per mile open was within a fraction of £50,000, so that in the interval there had been an average increase of about £7500 per mile; and as the number of miles of line open in England and Wales at the end of 1885 amounted to 13,612, the total difference in the expenditure per mile, as between the two periods, amounts to not less than 102 millions sterling.

Although we have not the accounts before us in detail, there can be little doubt that the chief sources of this very remarkable increase of capital expenditure have been the extension of station accommodation, the widening of lines and the increase of sidings, the purchase of additional rolling stock, the installation of the block and air-break systems, and other measures, either compulsorily demanded or voluntarily undertaken with a view to increasing the efficiency of the service and the safety of life and limb. But none the less is the item a serious one, and its seriousness is increased rather than diminished when it is compared with the corresponding figures for other countries. In the United States, there has been a

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much greater increase of traffic, as between 1872 and 1884, than in Great Britain, and yet the average increase of capital per mile of line open has been less than one-third of the increase that has happened in our own country.[1] In some Continental countries, an increase of traffic has been coincident with a decreased capital expenditure per mile of line open, in consequence mainly of the greater cheapness, within recent years, of all the materials of construction. To this latter source we should have been justified in looking for a diminished expenditure per mile of line open, on all railways—at any rate since 1879, when the era of cheap prices was fairly inaugurated; but even since then, the capital expenditure of the railways of the United Kingdom has been increased from £40,518 to £42,561 per mile. This fact appears to show that, as regards capital cost at any rate, English railways have gained little from the lower prices at which all commodities have been procurable within the interval. If we take the North-Western Railway as a typical example, we find that, during the ten years ending 1885, it expended over four millions sterling in additions and improvements to terminal stations at London, Birmingham, Liverpool, and Manchester. This outlay has, no doubt, tended to the great advantage of the public, but those facilities may be too dearly purchased after all; and the public should not forget that they can hardly possess, at the same time, magnificent stations and cheap rates and fares. It is true that the two things may not necessarily be incompatible; but it is also true that, if the public demand exceptional facilities, they must be prepared to pay an exceptional price for them; and it is worth while pausing to consider whether we have not been getting too luxurious and *exigeant* in our requirements. It is perhaps now too late to undo the mischief to which we refer; but we are not too late to determine that railway companies shall not be encouraged in this prodigal

[1] This is shown more specifically in the chapter on American Railways.

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expenditure on lines, the capital account of which ought to have been closed many years ago. This mortgaging of the future is not creditable to our appreciation of what is best for our present needs, or of what is most calculated to advance the interests of posterity.

The first thing that strikes a casual inquirer into the economics of railway working is the enormous disparity that is found between the construction cost of different railways. At the one end of the scale, we have the Metropolitan Railway, with a capital cost of over half a million per mile open;[1] and at the other, we have the Liskeard and Caradon line, costing less than £2000 per mile. Between these two extremes, there are all sorts of intermediate figures. The most expensive lines have been those constructed in the neighbourhood of the metropolis. Four of them have cost over £140,000 per mile, viz.:—

The Metropolitan	£515,073 per mile.
„ District	440,314 „ „
„ North London	324,655 „ „
„ Chatham and Dover	140,682 „ „

Of the main trunk lines, seven have cost over £50,000, and some over £70,000 per mile, viz.:—

The Manchester, Sheffield, and Lincoln	£82,888 per mile.
„ Lancashire and Yorkshire	79,889 „ „
„ South-Eastern	59,149 „ „
„ West Lancashire	58,400 „ „
„ Brighton and South Coast	55,887 „ „
„ North-Western	55,176 „ „
„ Midland	53,908 „ „

Of the other chief railways, the average cost per mile has been:—

[1] Mr. Bell, the general manager of the Metropolitan line, has called my attention to the fact that this cost includes the Harrow extension, which runs through an open country, and consequently was not so expensive as the line from Aldgate to South Kensington, which cost £772,000, or the City lines extensions, which cost £1,264,000 per mile.

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The Furness	£50,143 per mile.
„ Great Northern	44,665 „ „
„ North Staffordshire . . .	40,609 „ „
„ Great Eastern	38,238 „ „
„ North-Eastern	37,103 „ „
„ Great Western	30,981 „ „
„ Taff Vale	31,015 „ „

With these exceptions, and one or two others of minor importance, the average cost of the railways built in England and Wales has (not?) generally been as much as £30,000 per mile.

The question here naturally occurs, What is the explanation of the enormous differences shown in these figures? Is it due to the greater cost of the land, to the more costly gradients and alignment, to the more stable and expensive character of the works and ways generally, or to the acquisition of adjuncts that have been deemed requisite for the traffic, although not properly coming within the scope of a railway undertaking?

To furnish adequate replies to each and all of these inquiries would necessitate a very elaborate analysis of railway property generally. This, of course, cannot be attempted here. But it may be remarked that the nearer the railways approach the metropolis, and the greater their mileage within, or in the neighbourhood of, London, the higher becomes their average mileage cost. One cause of this is no doubt the more costly works involved to meet the special conditions of metropolitan working—especially the greater amount of tunnelling, and the more expensive station accommodation. Another is the very much higher cost of the land in the metropolis. Still others there are, which will occur to all who are more or less familiar with the question.

It is, however, important to remember that although the capital outlay on English railways is phenomenally high, so also is the volume of their traffic, and their average gross and net receipts per mile. The advantages possessed in this respect by English lines would enable

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them, if properly administered, to yield quite as good returns as those of other countries that have a much lower capital cost. But the system pursued on our principal railways does not, as already indicated, seem to promote this result. We have at once the largest gross earnings per mile and the lowest train-mile rate of any leading country in the world. This fact when placed alongside the high range of rates and fares, gives the key to the whole situation.

Perhaps the greatest defect in the administration of English railways is the practice which obtains of running only partially filled trains where full train-loads should be adopted. This is a defect that has been admitted most readily by railway managers themselves; but they likewise seek to defend the practice on the ground that it is demanded by the public, and that any departure from the now established usage would involve a withdrawal of facilities and conveniences to which traders would not care to submit. It is also urged that, in reference to the great bulk of the traffic, there is so much competition between the principal railways that if they did not each provide the best facilities within their power in the way of rapid delivery, they would be left behind in the race. This is no doubt perfectly true as regards the general merchandise traffic, and it also applies in a large measure to agricultural traffic, and especially to live stock. But it certainly cannot have any bearing upon mineral traffic, which amounts to nearly 70 per cent. of the whole. There is no reason whatever why mineral traffic should not be always, as it generally is, carried in full train-loads. It seldom happens that a few hours more or less make any difference in regard to its delivery. It is not a perishable commodity, and it is one that lends itself most readily to the highest demand of economic working, viz., the adoption of full and heavy train-loads. In England and Wales the quantity of general merchandise carried by railway in 1884 was 64½ millions of tons, out of a total of 220 millions of tons, being just about 30 per cent. of the whole. It is in

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respect of this proportion, therefore, that there is, or is supposed to be, a great deal of leakage, in consequence of the absence of full train-loads. Mr. Grierson has admitted that in England the ordinary goods-truck is not filled to the extent of more than one-half its carrying capacity—that instead of carrying 6 or 7 tons, it is usual to carry only 2½ or 3; and hence we find trains carrying no more than 70 to 100 tons, when they might just as well carry 250 or 300. Obviously, if the rule were the other way, the train mile receipts, instead of being only 4s. 10d. or 5s., should be double that figure; and as the cost of working goods traffic decreases in an almost direct ratio with the weight of the train, or rather of the live or paying load, the adoption of fuller wagon-loads would give a much higher range of receipts in proportion to the ordinary working expenses. This, of course, could not be done with some descriptions of traffic. It would be especially difficult with traffic to which the term *perishable* can properly be applied, but such traffic forms but a very trifling part of the whole—probably not more than 10 per cent.; and to the remaining 90 per cent. the system could certainly be applied with great advantage.

There are many points in respect of which English railways would do well to take a lesson from their American congeners. If American railways have in some respects set a bad example—if they have incurred odium and become disreputable, from the operations of financiers and speculators, from the "watering" of their stocks, the installation of "rings," and other equally equivocal devices,—they have at any rate earned the gratitude of their shareholders in particular, and of the trading community in general, in consequence of the enterprise and capacity which have enabled them to reduce the average rates of freight within ten years by one-half, and their working expenses by a corresponding, if not still greater, amount. There are many English railway authorities who do not admit the possibility of such an achievement. They ask

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incredulously, having in view only their own experience, Where has any such reduction come from? The economy that has undoubtedly taken place in American railroad transportation within recent years has been dealt with in previous chapters, and need not here be more particularly referred to, except to remark that the chief causes have been—

1. Increased capacity of freight cars or goods wagons.
2. Larger train-loads.
3. Better permanent way.
4. Increased efficiency of locomotives.

In the case of most American lines the live load is much greater, relatively to the gross or dead load, than in this country. It is not an easy matter to state the average load carried on English lines. There are, indeed, no direct means of reaching this desirable item of information. But it is probable that it is considerably under 100 tons. This conclusion is based on a very simple arithmetical calculation. The total receipts from goods traffic in 1885 on all the railways of the United Kingdom amounted to £36,871,000. The number of miles travelled by goods trains in the same year was 125,929,000. The average receipts per goods train mile would thus appear to have been 5.8s. Now, we have no direct clue to the average ton-mile rate on English railways, but if we assume that it is only 1d., we should arrive at an average of rather under 70 tons per train-mile; and inasmuch as the average ton-mile rate is generally believed to be nearer 2d. than 1d., the average live load of a goods train is likely to be nearer 50 than 70 tons. If it were assumed that all trains return empty, this figure would require to be doubled; but, while 90 per cent. of the mineral trains return empty, at least 80 or 85 of the ordinary merchandise trains find return freights. If, however, we assume that one-half of all the goods trains fail to find return loads, the average live load carried on our English railways would

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be found to be considerably under 100 tons, and probably not more than 75 tons, even on loaded trains.

It is interesting to compare this figure with those that apply to Continental countries and the United States. In those countries, as in Great Britain, the average weight of the loads carried on different railways is not specifically recorded. The process of statistical analysis may, however, give us some clue to such knowledge. By that process we can discover the average receipts per ton of merchandise or goods traffic carried in different European countries.[1] If, now, we divide the average gross receipts from goods trains per train mile, by the ascertained average receipts per ton per mile, we shall arrive approximately at the average weight of the goods trains of different countries, as in the following table:—

Statement showing the Average Receipts per Train Mile, the Average Ton-Mile Rates, and the Calculated Average Live Load Carried per Train Mile in European Countries and the United States.

Countries.	Average Receipts per Goods Train Mile.	Average Ton-Mile Rate.	Total Tons Carried per Train Mile.
	s.	*d.*	
Germany . . .	9.3	0.85	132
Austria . . .	12.3	1.05	139
Belgium . . .	6.1	0.77	96
France . . .	10.9	1.07	121
Italy . . .	8.1	1.20	81
Luxembourg . .	4.2	0.96	52
Russia . . .	12.0	1.16	124
Finland . . .	7.0	0.99	86
United States . .	8.9	0.62	173
United Kingdom .	5.9	1.00[2]	70

This method of estimation, so far as we know, has never been applied before. It may be open to objection, but no other method appears to be at command; and at any rate, so far as it goes, it shows that the average load carried on

[1] This is done, of course, by dividing the number of tons carried one mile into the gross receipts from goods traffic.

[2] This, as already stated, is an assumed figure.

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English lines is less than that of any other country except Luxembourg.

When we come to examine the passenger traffic returns of English railways, we find that the train-mile receipts are much lower even than those from goods traffic, amounting to only 3.5s. as against 5.8s., the average of the whole traffic of both descriptions amounting to 4s. 10d. per train mile. Within recent years the train-mile receipts have shown a tendency to fall off. Since 1875 the average train-mile receipts of the United Kingdom, as a whole, have fallen from 5s. 7½d. to 4s. 10d. The decrease in the receipts from passenger traffic have been more remarkable still.

The greater proportion of third-class or low-priced passenger traffic in the United Kingdom is likely to have something to do with the lower average receipts per train mile just alluded to. Those receipts are, of course, quite independent of the number of vehicles that may be made up in an average train, and are, in fact, nothing else than a function of the average number carried.

There is no charge that has more frequently been levelled at our great English railway corporations than that of running a needlessly large number of almost empty or half-empty trains, and thereby working at a loss, or, at any rate, with a remarkably and quite unnecessarily attenuated range of profit, the enormous passenger traffic at their command.

It is also made a subject of frequent animadversion that the third-class traffic, if not the goods traffic, is made to pay for working first-class traffic at a loss.

In briefly looking into these several questions, we propose to examine the relation of coaching stock to passenger traffic; to show how far each class is remunerative; and to endeavour to ascertain how far the results prove the number of passenger vehicles to be below or above the standard of really necessary efficiency.

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The average capacity of the railway carriages in this country is generally put at forty places per carriage. The average distance over which each passenger is carried in the United Kingdom is between six and seven miles. If a carriage were full at all times when it is in service, and were taken as running for only six hours a day, at an average speed of thirty-five miles per hour, it should in that period of time carry 1400 passengers, or 420,000 per year of 300 working days. The actual average number of passengers transported per carriage on British railways is not more than 22,000 per annum, or 60 per day. The meaning of this appears to be that passenger carriages are not now doing much more than one-twentieth of the work they might accomplish. Here there is a manifest waste of resources; and it would undoubtedly be much to the advantage of railway shareholders, as well as of the general public, if things were differently ordered in this respect.

This condition of affairs is not of recent origin; it has existed for many years. But the evil is getting worse rather than better. Since 1874 the average earnings per passenger carriage have been reduced from £888 to £774, or about 13 per cent., as the following figures show:—

Statistics of Passenger Traffic in England and Wales, 1874–1885.

Years.	Number of Passenger Carriages.	Gross Earnings from Passenger Traffic (£1 = 1000).	Total Number of Passengers Carried (1 = 1000).	Gross Earnings per Carriage.
1874	21,148	£18,772	423,084	£888
1875	21,838	19,364	451,033	887
1876	22,757	19,623	477,146	862
1877	23,154	19,846	490,352	857
1878	23,320	20,047	503,983	860
1879	23,877	19,341	503,653	810
1880	24,658	20,341	540,669	825
1881	25,542	20,690	561,175	810
1882	26,224	21,573	586,690	823
1883	27,274	22,059	612,402	809
1884	27,905	22,247	621,131	797
1885	28,352	21,968	622,169	774

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It is perfectly true, and necessary to remember, that this reduction of earnings per carriage has been coincident with a very considerable increase of third-class, and a consequent decrease of first-class, travel; but, on the other hand, third-class carriages are, or should invariably be, fuller than first-class, and they also contain a considerably larger number of places—two elements that ought to fully compensate for the reduction in the number of first-class travellers. It is only necessary to add that the average receipts per carriage are, after all, higher in England than in other leading European countries, but this may be because passenger fares take a higher range. The averages for the chief European countries are as under:—

Countries.	Total Number of Carriages.	Total Passenger Receipts (£1 = 1000).	Average Receipts per Carriage.
Germany	20,843	£11,016	£529
Austria-Hungary . .	7,607	4,827	633
Belgium	3,386	1,705	504
France	18,004	13,425	745
Italy	4,943	3,200	648
Russia	6,696	7,110	1,020

There has hitherto been a great lack of knowledge in this country as to the extent to which the different classes of passenger traffic yield adequate profit to the railway companies. English passenger traffic differs from that of most of other countries in this respect, that the chief companies attach third-class carriages to almost every train. The accommodation provided for third-class passengers in England is also much superior to what is found in other countries where there is the same distinction of classes. The effect of these two distinguishing features of the English railway system is that third-class carriages are much more, and first-class carriages much less, utilised than in other countries. The tendency appears to be towards an increasing use of third-class, and a decreasing

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use of first-class, vehicles. But all the same, the leading English lines continue to provide a large proportion of first-class accommodation in every train, and it is no unusual thing to find the third-class carriages of express trains absolutely full, while first-class carriages are almost empty. The natural result is that third-class travel is a source of profit, while first-class travel is not. There are not wanting proofs of this fact.

The coaching and passenger traffic returns of the London & North Western Railway Company show the following results for 1885:—

Description.	Number.	Passengers Carried.	Average per Carriage per Annum.
First class	1,697	2,170,442	1,285
Second class	182	3,700,459	20,330
Third class	1,784	48,978,129	27,460
Totals and average .	3,663	54,849,030	15,000

The receipts from each description of carriage have been as under for the same year:—

Description.	Number.	Gross Receipts.	Average per Carriage per Annum.
First class	1,697	£500,833	£295
Second class	182	361,650	2,000
Third class	1,784	2,290,883	7,280
Totals and average .	3,663	£3,153,366	£860

These figures are, however, affected by one important disturbing element. The first-class carriages are classed with composites, and as there is no record of the total number of composite carriages, nor of the proportions of

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first and third class seats in each, it is impossible to fix how far the proportions of first and third class traffic may be thereby altered.

In the case of the Midland Railway, there is less difficulty in arriving at a correct estimation of the results of working first and third class traffic. On that line the composite carriages are separately distinguished, and if we allow that they should be apportioned in equal parts to the first and third class stock, respectively, the results will come out as follows:—

Description.	Number of Carriages.	Total Passengers Carried.	Average per Carriage.
First class . . .	786	1,528,786	1,944
Third class . . .	1,729	30,717,762	17,765
Totals and average	2,515	32,246,548	12,821

With regard to receipts, it appears that the first and third class carriages, respectively, yielded the following averages in 1885:—

Description.	Number of Carriages.	Gross Receipts.	Average Receipts per Carriage.
First class . . .	786	£259,721	£330
Second class . .	1,729	1,541,515	885
Totals and average	2,515	£1,801,236	£716

Each third-class carriage belonging to the Midland Company appears to have conveyed 15,821 more passengers than the first-class, being an increase of 814 per cent. Each third-class carriage also earned £555, or 168 per cent. more income in the course of the year than carriages of the superior class.[1] It is important to bear these

[1] It should be noted that these figures do not include season-ticket holders, from which the company earned a further sum of £19,877. Although this is only a comparatively small item, it introduces a disturbing element that must be taken into account. If, however, we assign the whole of the receipts from season tickets to first-class travel, the average receipts per first-class carriage would only be raised thereby to £353 per annum.

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figures in mind in considering the cost of working passenger traffic. The first-class carriage, to begin with, costs nearly twice as much as the third, it is more expensive to repair, and it is run at greater speeds, where there are—as on the railways south of the Thames—express trains with no third-class carriages attached. But this is not all. The best and most costly accommodation is provided for first-class passengers at stations and otherwise; and if porters are not retained specially for first-class passengers, they at any rate give more conspicuous attention to that class.

The same condition of things, more or less modified in degree, will be found to apply in the case of every railway company in this country. So far as passenger traffic is a source of net profit, that profit is contributed by the third class. The total receipts from passenger traffic in England and Wales amounted in 1885 to £21,968,000. But if the average receipts per carriage over the whole had been the same as in the case of the Midland first-class vehicles—namely, £330—the total receipts from passenger traffic would only have been about nine millions. It is not necessary to be an expert in order to see that traffic so conducted must be attended with a very serious loss. The sooner English railways put their house in order in this respect, the better for themselves and for the country at large.

It has been claimed by an American authority[1] that the American locomotive is a much more economical machine than the English, alike in respect of its earning capacity and its cost of maintenance. It is certain that within recent years the carrying capacity of American locomotives has been largely increased. The introduction of steel rails and a heavier weight of permanent way have enabled much more powerful locomotives to be employed, and have consequently led, in the United States, to the adoption of a

[1] Dorsey on "English and American Railroads Compared."

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much heavier average train-load. Thus, in America, the Pennsylvania Railroad Company increased the average weight of the load carried per train, between 1870 and 1882, from 112 to 186 tons, or 66.7 per cent. On the Pittsburg, Fort Wayne, and Chicago line, the weight of the load in the same interval was increased from 102 to 171½ tons, or 66.9 per cent. And so with most of the other leading lines.[1] Hence the average gross and net earnings of an American locomotive have within recent years been largely increased. But in England, where the average weight of the load carried has not been materially increased, if at all, the average earnings of a locomotive have diminished. The following table shows this relation for the period 1872–85:—

Statement showing the Annual Gross Earnings per Locomotive in England and Wales for the period 1872–85.

Years.	Number of Locomotives.	Gross Receipts from all Traffic (£1 = 1000).	Average per Locomotive.
1872	8,687	£43,376	£4,993
1873	9,111	47,061	5,165
1874	9,554	48,142	5,039
1875	10,000	49,771	4,977
1876	10,439	50,504	4,838
1877	10,636	51,063	4,801
1878	10,804	51,069	4,727
1879	10,977	50,437	4,595
1880	11,172	53,598	4,798
1881	11,474	54,924	4,787
1882	11,847	56,596	4,777
1884	12,482	60,099	4,815
1885	12,840	59,320	4,620

Between the maximum of £5165 and the minimum of £4595 shown in this table, there is a difference of £570, and it will be noted that in the year 1885 the earnings

[1] Some interesting details bearing upon this point are contained in a report presented by my friend Mr. William P. Shinn to the reporter on the Internal Commerce of the United States for 1882.

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were the lowest on the record except those of 1879. It is manifest that if heavier train-loads were adopted, the earnings of English locomotives would be correspondingly increased.

The locomotive earnings of the chief European countries besides our own are shown in the following statement:—

Countries.	Number of Locomotives.	Total Gross Earnings (£1 = 1000).	Average Earnings per Locomotive.
Germany	11,330	£48,494	£4,280
Austria-Hungary . .	3,671	23,080	6,287
Belgium . . .	1,790	6,479	3,620
France	8,088	45,021	5,566
Italy	1,630	8,245	5,058
Russia	5,844	34,424	5,890

According to these figures, it would appear that, with the exceptions of Germany and Belgium, Continental nations possess a higher average locomotive income than England. This is certainly not due to a higher average range of rates and fares, but it may fairly be attributed to greater care in the economical working of locomotives, and especially to the running of fuller train-loads.

The element of speed has undoubtedly a great influence on the average cost of railway working. There is, however, a want of specific *data* as to the precise effect of speed on the cost of working a train. It is calculated that on the majority of the English trunk lines the average speed of goods trains is about twenty miles, and of passenger trains about thirty-five miles, per hour. Mr. Findlay stated some years ago that the average speed on the London and North-Western Railway was 18 miles per hour for the former, and 30 miles for the latter. Some years previously the average speed was not so great. There was, indeed, a not uncommon impression that, beyond a certain limit, the slower the speed the greater the economy of working. One witness stated to the Royal

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Commission of 1866 that on the Great Northern line the best and most economical speed for all trains was about fifteen miles an hour; but that the coal trains, not being able to get up the rise of the gradients as fast as the average time, ran down inclines at the rate of thirty miles an hour.[1] The same witness maintained that the locomotive expenditure would be increased from 7½d. to 8½d. or 9d. per train mile by raising the rate of speed from thirty to forty miles per hour, and that every other item of working expense would be more or less augmented (as the signals, permanent way, &c.), because the higher the rate of speed, the better and more efficient must be the condition of the permanent way. In the United States there has recently been a very considerable augmentation of average speeds, especially for goods and mineral trains which are now run at fifteen to twenty miles per hour.[2] Experiments made with a "dynograph" car in the United States have shown that a speed of eighteen miles per hour for goods trains is more economical of fuel, and requires less power than a slower movement.[3]

The opinions entertained by the earlier railroad inquirers were decidedly unfavourable to high rates of speed, from the point of view of economy. Thus, Mr. Nicholas Wood sets out[4] that, at a speed of eight miles per hour, the cost of haulage would be .375d. per ton per mile; but at a speed of twelve miles per hour, this cost would be raised to .5d., and at twenty miles to 1.73d. It was, therefore, held that an increase of twelve miles an hour in the speed would cause an augmentation of 370 per cent. in the cost of haulage. The experience of later engineers have greatly modified these figures.

There cannot be any question that the practice of run-

[1] Report, Minutes of Evidence, p. 883.

[2] Mr Shinn's Report to the Secretary of the Interior on "The Increased Efficiency of the Railroad System of the United States." "Report on the Internal Commerce of the United States for 1882," p. 301.

[3] *Ibid.*

[4] "Practical Treatise on Railroads," p. 616.

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ning a great many only partly full express trains on all our principal lines has little to recommend it beyond public convenience. The railway companies have never yet shown what it costs to carry on their express-train traffic, as distinguished from the rest. It is not, however, too much to affirm, that when the wear and tear of the rolling stock and permanent way are considered, and the shunting and delay occasioned to the slower traffic, the express-train traffic is not adequately remunerative, if, indeed, it does not involve a real loss. In no other country are there so many express trains as in England, and nowhere else do trains generally travel at the same high rate of speed.

On a survey of the whole matter, there would appear to be too much reason to believe that the financial position and prospects of English railways are going from bad to worse. Our railway boards have not, as yet, adequately realised this great fact, and have consequently done little or nothing to stem the tide of insolvency that threatens to overtake them, unless they mend their ways. In England alone, there were last year (1885) about 36½ millions of ordinary railway stock upon which no dividends whatever were paid. There were 14½ millions more upon which the dividends paid did not exceed 2 per cent. These two items together made up 20 per cent. of all the ordinary capital of English lines. Is this an adequate result for the finest railway system in the world—for the system that has the largest volume of both gross and net receipts, that has the cheapest materials of construction at command, and almost, if not quite, the highest range of rates and fares? There can only be one answer to such a question. That answer will be more imperatively insisted on than it has hitherto been, if our railway boards should fail to meet their own interests, and the manifest requirements of the trading and travelling public, by sounder methods of finance and administration.

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The following are among the sources whence economy in the working of English railways, and consequent increase of profits, or reductions of rates and fares, or both desiderata together, may be expected in the future:—

(1.) The adoption of a slower average rate of speed for goods trains.

(2.) The reduction of tare, so as to allow of a greater live or net load being carried, relatively to the weight of the vehicles employed.

(3.) The adoption of heavier truck and carriage loads, or, in other words, the running of fewer empty wagons and carriages, and possibly fewer trains.

(4.) The avoidance of duplicate trains from practically the same termini for practically the same destinations.

(5.) An endeavour to redress the difference in the balance of goods sent in opposite directions.

(6.) The transfer of a great part of the heavy traffic to the canals, or the increase in the number of special lines provided for such traffic, so as to get rid of the loss of time and capital involved in shunting to make way for the passenger traffic.

(7.) The publication of railway accounts on a principle that would allow of the ton-mile rates being readily ascertained as regards both cost and profit.

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CHAPTER XXIV.

SCOTCH RAILWAY ADMINISTRATION.

THE first public railway constructed in Scotland was a tramroad, nine and a half miles in length, which connected Kilmarnock with Troon. Parliamentary sanction was obtained for this undertaking in 1808, and the line was opened four years later, the carriages being drawn by horses. The Carron Iron Company, about the same time, connected their works with their mines, &c., by means of a tramway; while so early as 1810, it was proposed to connect Glasgow and Berwick by a horse-railway, and the ground was actually surveyed by Telford for that purpose. It was not, however, until 1826 that any railway of real importance was constructed in Scotland. In that year, the people of Edinburgh commenced a line that was designed to connect their city with Dalkeith, and it is worth noting that this line was worked by horses until 1845, when it was acquired by, and incorporated in the system of, the North British Railway Company.

Scotland, therefore, can claim a very early, and a not undistinguished, connection with the railway system; nor has the prestige thus acquired been dimmed by the later experience and achievements of Scotch railway enterprise.

In considering the special circumstances of the Scotch railway system, we are struck, first of all, with the extent to which centralisation and amalgamation have induced economy of working. There are only seven separate railway companies in Scotland, and one of these is of very

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little account indeed, while the traffic of another—the City of Glasgow Union—is worked by the several companies that make use of the line.

The total mileage of the Scotch railways open at the end of 1885 was 2982 miles, of which 1800 miles were single, and 1182 miles were double or more. This is rather over 15 per cent. of the total railway mileage of the country. Relatively to area, Scotland is not so well supplied with railway facilities as England. Measured by the test of population, however, Scotland is in advance of the sister-country, having one mile of railway to every 1310 inhabitants, while in England there is one mile of railway to every 2020 inhabitants.

The Scotch railways carried, in 1885, 26½ millions of tons of mineral and 8¼ millions of tons of other traffic; while in England and Wales, the total volume of traffic carried on the railways in the same year was 219 millions of tons. As we shall afterwards see, the railways of Scotland carry more goods traffic per head of the population than those of England.

With regard to passenger traffic, it appears that in Scotland, the railways carried, in 1885, about 56 millions of passengers, being roughly fourteen passengers for every head of the population. In England and Wales, the number of passengers carried by railway in 1885 was 62¼ millions, representing an average of about twenty-three for every head of the population. In Scotland, however, the average receipts per passenger carried were higher than in England and Wales, amounting to 9½d. as against 8d.—which would seem to prove that the average length of journey was greater in the more hyperborean part of the kingdom.

The principal passenger-carrying line in Scotland is the City of Glasgow Union, which, in 1885, carried about 4½ millions of passengers, being an average of 640,000 passengers per mile. This, however, is far from equalling the density of passenger traffic on the Metropolitan Rail-

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way, which, in the same year, carried about 56½ millions of passengers, being an average of about 2½ millions per mile. Season ticket-holders are not reckoned in either case.

The number of passenger vehicles, and the average number of passengers carried in each, are shown for the several Scotch railways, as regards 1885, in the following table:—

Relation of Passenger Vehicles to Passengers Carried.

Railways.	Number of Passenger Carriages.	Number of Passengers Carried (1=1000).	Average Number of Passengers per Vehicle.
Caledonian	1,219	17,002	13,948
Glasgow Union[1]	...	4,480	...
Glasgow and South-Western	685	8,703	12,705
Great North of Scotland	227	2 066	9,100
Highland	213	1,488	6,938
North British	1,415	21,994	15,544
Totals and average	3,759	55,733	14,826

Of the total *ordinary* capital embarked in Scotch railways at the end of 1885, amounting to 33½ millions, there were 7 millions upon which no dividend whatever was paid, being about 20 per cent. of the whole. In England and Wales, for the same year, no dividends were paid upon 36½ millions of the total ordinary capital of 252 millions, being 14 per cent. of the whole.

The average cost of the Scotch railways has been considerably under that of the English lines. The highest average expenditure per mile has been incurred on behalf of the Glasgow Union line, in which case it amounts to £183,571; but this outlay, high though it be, compares favourably with that incurred on behalf of the Metropolitan and Metropolitan District lines, some parts of which have cost over a million sterling per mile. Why there

[1] The passenger traffic on this railway is carried in the trains of the Companies using the line.

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should be this serious difference of cost, is a problem well worth investigation. These several lines have much in common. They have all been constructed in the heart of large cities, and the Glasgow Union has had to acquire probably more land and property, for its extent, than either of the metropolitan lines. But, on the other hand, it has not involved any tunnelling to speak of, and it has not incurred any expenditure for rolling stock, which is a large item in the cost of the London lines.

The details of the Scotch railways, as regards capital outlay, are shown in the following table:—

Statement showing the Capital Expenditure upon Scotch Railways to the End of 1885, *and the Average Outlay per Mile.*

Railways.	Miles Open at End of 1885.	Capital Expenditure to End of 1885 (£1 = 1000).	Average Outlay per Mile Open.
Caledonian	819	£38,705	£47,258
Glasgow Union	7	1,285	183,571
Glasgow and South-Western	343	13,573	39,571
Great North of Scotland	298	4,870	16,342
Highland	418	4,446	10,636
North British	1,015	34,582	34,071
Portpatrick and Wigtown	82	663	8,085
Totals and average	2,982	£98,124	£32,905

The Scotch lines have apparently been smitten with the same fell disease as the English, as manifested in the increase of their capital expenditure on already existing lines. In 1872, the average capital outlay per mile of line open in Scotland was only £25,800, so that, between that year and 1885, the average capital expenditure had been increased by over £7000 per mile.

On analysing the accounts of the different companies, we find that the Caledonian has, in this interval, increased its capital expenditure from £29,100 to £47,258 per mile of line open. The North British has in the same period

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increased its capital from £27,300 to £34,071 per mile open. In the former case, there has been an increase of about £18,000, and in the latter, an increase of about £7000 per mile of line open. The difference in the case of the Caledonian is very remarkable. The Board of Direction may be in a position to afford satisfactory evidence that this money has been wisely expended. Much of it has gone in providing increased rolling stock, as is perfectly evident by the fact that between the two dates the Company increased their total vehicular stock from 29,644 to 46,053, the difference being mainly represented by the acquisition of the traders' wagons over the whole system. But even when this outlay has been most liberally allowed for, there remains an enormous balance, that causes the Caledonian to compare unfavourably with other lines, and especially with its neighbour and rival, the North British, in respect of which the Tay Bridge construction and disaster, and the Forth Bridge, now in course of erection, must have compelled an increased and readily appreciable capital outlay.

It may be noted that, of the two great Scotch railways—the Caledonian and the North British—the former has the largest mineral, and the latter the greatest passenger, traffic. In extent of mineral traffic the Caledonian is only excelled by four English lines—these being the North-Eastern, the North-Western, the Great Western, and the Midland; while it carries, on less than one-third of the whole mileage of the country, about one-half of the whole mineral traffic.

The gross earnings from railway working in Scotland varied in 1885 from a minimum of £285 per mile in the case of the Portpatrick and Wigtown line, to a maximum of £8982 per mile in the case of the Glasgow Union. The latter is almost entirely a passenger-carrying railway, and for that reason it is interesting to compare its gross mileage receipts with those of the two chief metropolitan railways, which possess much the same character. On the metropolitan district line, nineteen miles in length, the

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total receipts in 1885 amounted to £430,640, being an average of £22,631 per mile. On the Metropolitan line, the average for the same year was £27,190 per mile, the mileage being 24 miles, and the gross receipts £653,000.

The following statement shows the total and average gross and net earnings on Scotch railways:—

Statement showing the Gross and Net Earnings from Traffic on the Railways of Scotland in 1885.

Railways.	Gross Earnings.	Net Earnings.	Gross Earnings per Mile.	Net Earnings per Mile.
Caledonian . . .	£2,954,562	£1,461,565	£3,608	£1,785
Glasgow Union . .	62,872	46,016	8,982	6,574
Glasgow and South-Western	1,095,739	532,114	3,194	1,551
Great North of Scotland .	315,787	152,394	1,060	511
Highland	386,784	182,809	925	437
North British . . .	2,594,224	1,291,896	2,556	1,273
Portpatrick and Wigtown	23,369	4,328	285	53
Totals and averages .	£7,433,337	£3,671,122	£2,493	£1,231

In some previous chapters, we have referred, more or less incidentally, to the differences that distinguish the Scotch from the English railways, in reference to their administration and working. England has a higher average train-mile income than Scotland, the figures for each country having in 1885 been as under:—

Description.	England and Wales.	Scotland.
	d.	*d.*
Passenger trains	50.44	46.37
Goods trains	71.86	63.01

It would appear, from these figures, either that the average load carried on the English lines was greater, or that the rates and fares were higher, than in Scotland.

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The gross income per open mile of railway is also higher in England, as the following figures show :—

Description.	Gross Income per Open Mile in	
	England and Wales.	Scotland.
Passenger trains	£1,918	£978
Goods trains	2,397	1,476

From all trains together, the gross income in Scotland only amounted to £2453 per open mile of line, as against £4315 in England and Wales, showing a difference in favour of England and Wales of £1860, or 76 per cent.

Of the total gross receipts derived from railway working, Scotland has a much larger percentage from goods traffic than either of the sister countries. The difference is, however, a diminishing, and not an increasing, one. In 1874, the Scotch lines drew 62 per cent. of their total receipts from goods traffic, as against 56 per cent. in England and Wales. In 1884, only 60 per cent. of the Scotch railway receipts were derived from this source, while the percentage proportion drawn by England from the same source remained stationary.

Again, of the total gross railway receipts, Scotland takes 52.1 per cent. for working expenses, as against 53.0 per cent. for England and Wales, and 56.2 for Ireland. In this respect, therefore, Scotland compares favourably with the other two divisions of the kingdom. The comparison is more favourable still if we extend it over a series of years. Between 1874 and 1884, the working expenses of Scotch lines were reduced from 56.8 to 52.1 per cent. of the gross receipts, as against a reduction from 55.4 per cent. to 53.0 per cent. in the case of England and Wales, and a reduction from 57.0 per cent. to 56.2 per cent. in the case of Ireland.

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The sources of this diminished cost of working the Scotch lines may be traced in the following table:—

Statement showing the Expenditure per Train-Mile on the Railways of Scotland for 1874 and 1884.

Items.	1874.	1884.
	d.	d.
Maintenance of way	7.79	5.52
Locomotive power	9.34	7.26
Repairs and renewals	3.37	3.40
Traffic charges	9.07	8.39
General charges	1.18	1.19
Rates, taxes, and duty	1.66	1.63
Miscellaneous	1.69	1.37
Totals . . .	34.10	28.76

Within the same interval, the working expenses of English railways were reduced from 38.52 to 31.98 per train-mile, or from £2294 to £2287 per open mile. The working expenditure per open mile does not appear to be nearly so high in Scotland as in England, which is no doubt mainly due to the smaller volume of traffic dealt with. In 1884, the two countries showed the following comparative figures:—

Statement showing the Expenditure per Open Mile of Railway for England and Wales and Scotland, respectively.

Items.	England and Wales.	Scotland.
Maintenance of Way . .	£409	£245
Locomotive power . . .	609	323
Repairs and renewals . .	212	151
Traffic charges	729	373
General charges . . .	105	53
Rates, taxes, and duty . .	152	72
Miscellaneous	71	61
Totals . . .	£2,287	£1,278

The most remarkable feature in this statement would appear to be that of rates, taxes, and Government duty,

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which amounts in Scotland to less than one-half the sum paid in England per mile open. Traffic charges also appear to be much less in Scotland—a fact that may be attributed in great part to the lower range of wages. The difference in locomotive power is probably a result of the cheaper fuel that most of the Scotch lines have at command, and the slower rates of speed adopted.

So far as the average receipts earned by the railway companies per head of the population enable a judgment to be formed, Scotland is not behind England and Wales in reference to the extent to which her people adopt the facilities furnished by her railway system. The passenger receipts *per capita* amounted to the following sums in the years named :—

Years.	England and Wales.	Scotland.	Ireland.
	s. d.	s. d.	s. d.
1861	9 7	6 5¼	2 7¼
1871	13 0¼	9 6½	3 10
1874	15 8¼	11 6¼	4 4
1881	15 9	12 1	4 5
1885	15 7	14 9	5 5

It will be observed that the progress of Scotland has been more steady and continuous than that of England; and when the more rural character of her population is considered, the comparison would appear to be all the more in her favour.

When the comparison is extended to goods traffic, Scotland comes out better still, as the following figures show :—

Years.	Tonnage Carried per Head of Population in		
	England and Wales.	Scotland.	Ireland.
1861	3.79	5.12	0.29
1871	6.18	7.75	0.54
1881	7.94	9.00	0.69
1885	7.95	8.91	0.76

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It therefore seems that a higher tonnage *per capita* is carried by the Scotch than by the English lines, and an infinitely higher tonnage than is moved on the railways of Ireland. This fact is to some extent reflected, as we might expect, in the goods traffic receipts per head of the population, which amounted to the following items:—

Years.	Goods Traffic Receipts *per capita* in		
	England and Wales.	Scotland.	Ireland.
	s. *d.*	*s.* *d.*	*s.* *d.*
1861	12 7¼	12 5	1 10¼
1871	19 8¾	18 7	3 7
1881	23 9	22 10	4 6½
1885	22 9	22 0	5 1

Thus, although Scotland furnishes a larger tonnage *per capita*, she does not contribute a correspondingly higher range of traffic receipts, which may, of course, be due to several causes, but most probably to the lower average length of lead.

The results obtained by the several Scotch railways, in reference to the economical employment of locomotive power, may be traced in the following statement:—

Statement showing the Total Number of Locomotives Owned by Different Scotch Railways, with the Gross Annual Receipts and the Total Train-Miles Travelled per Locomotive.

Railways.	Total Locomotives.	Gross Annual Receipts. £1 = 1000.	Receipts per Locomotive.	Total Train-Miles Run in 1885. 1 = 1000.	Average Train-Miles per Locomotive.
Caledonian . .	690	£2,954	£4,281	12,452	18,047
Glasgow Union . .	...	63	...	...	...
South-Western . .	291	1,096	3,766	4,564	15,685
North of Scotland .	71	316	4,451	1,473	20,757
Highland . . .	75	387	5,160	1,673	22,312
North British . .	585	2,594	4,434	11,682	19,970
Portpatrick, &c. .	6	23	3,833	180	30,009
Totals and average	1718	7,433	£4,327	32,026	18,641

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The highest average annual receipts per locomotive were earned in 1875, when they amounted to £4481. Over the last fifteen years, the lowest average was £3961 per locomotive in 1879, and it is a hopeful feature that, although trade generally was equally depressed in 1885, the average was raised in that year to £4327, as above shown.

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CHAPTER XXV.

SPECIAL FEATURES OF IRISH RAILWAYS.

No student of history can fail to be struck with the uniformly dreary and depressing character of the record that sets forth Ireland's true place in the economy of nations. Her people are steeped in the deepest poverty. Her agriculture is perhaps more backward than that of any other country in Europe, notwithstanding her nominal affiance with a nation that has been the pioneer of the most important improvements in husbandry. Her industry has been hampered, demoralised, and blighted in a thousand different ways, until it is but the ghost of what it ought to be; and this, too, in spite of her possession of considerable natural resources, and labour that is both capable and cheap. Of commerce, except in agricultural products, she has next to none, notwithstanding that she has a finer, larger, and better situated seaboard than almost any other European nation. It almost follows, as a necessary corollary, that her railway resources are behind those of Great Britain, alike in their extent and in their suitability to the requirements of her people.

There are many features that distinguish the railways of Ireland from those of the rest of the United Kingdom. One of the most striking of these is the fact that the Irish railways have cost much less to construct than either the English or the Scotch. There is no reason, on the face of it, why the construction of a railway in Ireland should cost only £14,000 a mile, as compared with £50,000 a mile in England and £33,000 in Scotland, yet such is really the

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case. No doubt a great deal of the difference is due to the much greater extent of double mileage in England and Scotland. It appears that, at the end of 1884—

Of 13,340 miles constructed in England and Wales, 8504, or 64 per cent., were double or more.

Of 2999 miles constructed in Scotland, 1161, or 38 per cent., were double or more.

Of 2525 miles constructed in Ireland, 574, or 22 per cent., were double or more.

There are, however, other, and even more obvious, causes than this for a lower first cost. The price paid for the land in Ireland has not generally been so high as in either of the other two countries; and if the same price, or even rather more, has generally been paid for materials of construction, there has been less money spent in permanent erections, in rolling stock, in making arrangements for the collection and distribution of traffic, and in labour, which is a very important item in the first cost of all structures. Besides these items of difference, it is requisite to bear in mind that there have not been the same costly urban lines constructed in Ireland as in England and Scotland. If the cost of the metropolitan lines and termini were to be eliminated from the capital account of our English lines, and that of the Glasgow lines and stations from the capital of the Scotch railways, the average cost per mile would come out as a much lower figure.

The total capital authorised for Irish railway construction to the end of 1884 was rather over 40 millions sterling, of which 35¾ millions had been raised. Of the latter amount, 25¾ millions were stock and share capital, and 10 millions were loans and debentures.

It is worthy of note, moreover, that a considerably larger share of the total capital raised for the construction of Irish railways is ordinary or unguaranteed capital than in the case of English and Scotch lines, the proportions being—

37 per cent. in England and Wales.
34 „ „ Scotland.
46 „ „ Ireland.

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This would seem to prove that capital, whether Irish or otherwise, had been put into Irish railways more readily, on the simple faith of the investment, as such, than in either of the sister kingdoms. The amount, of course, is absolutely a very small one by comparison; but it is not relatively small, and especially when considered in reference to the resources and wealth of the country.

The Irish railways have scarcely justified this exceptional confidence in their dividend-yielding capabilities. They have, on an average of years, shown a better annual return than the Scotch lines, but a considerably inferior one to that yielded by those of England. They have also followed the same tendency as the English and Scotch lines, in reference to a lower rate of dividend over recent years. In 1869, the proportion of net receipts from the working of the Irish railways to the total share and loan capital was 3.58 per cent.; in 1876, it had increased to 4.14 per cent.; in 1881, it had fallen again to 3.29 per cent.; and in 1884, it had improved to 3.41 per cent. These variations are not exactly reflected in the movement of English and Scotch railway earnings over the same period, so that it is worth while inquiring how it comes about that the Irish lines have turned out as they have done.

The highest rate of dividend that has ever been attained by the Irish railways as a whole was that shown in 1876, when the net receipts were equal to the payment of 4.14 per cent. on the capital invested. In that year there were 2157 miles of railway laid down in Ireland, at a total cost of 30¾ millions sterling. Since then, the mileage of line open has been increased to 2525 miles, being an increase of 368 miles, and the capital expenditure incurred has increased to 35¾ millions sterling, being an addition of about 5 millions sterling. If we divide the additional mileage constructed into the additional capital raised in the interval, we shall find that the result represents an average of £13,600 per mile constructed, being, unlike the tendency of England and Scotland over the same

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period, a decreased rather than an increased outlay per mile open, over the period in question. There does not, therefore, appear to be any good ground for supposing that the less remunerative character of Irish lines has been due to the wasteful and extravagant expenditure of capital, relatively to the additions made to the mileage open, and the consequent presumed earning power of the railways as a whole.

When, however, we come to consider the actual earning power of this additional capital, we are confronted with the real source of the evil we are seeking to trace. The total receipts of Irish railways, from all sources of traffic, were £2,774,000 in 1876, and £2,828,000 in 1884. The average gross earning power of goods trains was £599 per open mile of railway in 1876, and only £504 in 1884. Here we have a falling off to the extent of £95 per mile, or 16 per cent. In the case of passenger trains, there was a decline from £669 to £600 within the same period. This movement has been equally apparent in the earnings per train-mile, which amounted to 56.36d. for passenger trains, and 106.66d. for goods trains, in 1876, against 46.81d. and 78.63d., respectively, in 1884. In both descriptions of traffic, the receipts were only 56.38d. per train-mile in 1884, as compared with 67.31d. in 1876, giving a decline of 10.93d. in the interval.

In the case of the railways of England and Scotland, the course of events over the same period has been very different. English lines increased their gross earnings from £4213 to £4315 per open mile, and Scotch lines from £2449 to £2453, as between 1876 and 1884. It is, however, a noticeable feature, common to all three countries alike, that there has been a decline in the gross earnings per train-mile—a fact which would seem to point to the exercise of less care in obtaining full train-loads, and perhaps, also, to the reduction of the rates of freight, although we have elsewhere shown that this is not by any means manifest.

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There is, however, the clearest evidence that either (1) as between 1876 and 1884, there has been a considerable reduction in the average rate of charge made for goods transport in Ireland; or (2) that, within the same interval, there has been a considerable reduction in the average distance over which the goods traffic has been carried.

In 1876, the average receipts for each ton of goods, of all kinds, carried in Ireland, was 7.3s.; in 1884, the corresponding average was 6.6s.; so that there was a reduction of .7s. in the interval. In England and Wales, the corresponding figures were 3.2s. for 1876, and 2.9s. for 1884, making a difference of only .3s. per ton moved, or less than one-half that which took place on the railways of Ireland. It is, of course, to be observed, that the average receipts per ton moved must not be taken as indicating either high or low rates, since there is no clue to the average distance carried. In Ireland, there is little doubt that goods traffic is carried a longer distance, on an average, than in England and Scotland, where many millions of tons of minerals are moved—as on the Wishaw and Coltness branch of the Caledonian Railway, and on the Guisbrough branch of the North-Eastern Railway—for less than 1s., and often for less than 6d., per ton, over the whole distance. There is also good reason to believe that the average ton-mile rate is considerably higher on the Irish lines, where the traffic is not so generally carried in full train-loads as on our great English mineral-carrying railways, and where it is usually less easily handled, and more liable to damage.

There would appear to be a tendency in Ireland to a considerable increase of mineral and live stock traffic, and a decrease in general merchandise. The receipts from all three sources of traffic, in the years 1876 and 1884, were as under:—

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Items.	1876.	1884.	Increase (+) or Decrease (−) in 1884.
General merchandise .	£996,381	£917,305	− £79,076
Live stock . . .	221,538	225,870	+ 4,182
Minerals . . .	74,969	128,533	+ 5,3564
Totals . .	£1,292,888	£1,271,558	− £21,330

With reference to passenger traffic, the Irish railways show, as between 1876 and 1884, an increase of more than two millions in the total number carried, and of £37,000 in the receipts therefrom. The average receipts per passenger carried was 1.01s. in 1876, and 1.3s. in 1884, as compared with 0.8s. per passenger in 1876 and 0.7s. in 1884, in England and Wales. It would, therefore, seem to follow, either that the average distance travelled per passenger was greater in Ireland, or that the general range of the fares charged was higher than in England and Wales. The probability is, that both influences have contributed their quota to the higher average receipts per passenger which we have seen to apply to the sister isle.

There is another feature of the passenger traffic of Ireland that merits attention. The average number of passengers who travel in that country per mile of railway open is much under that of either of the other two divisions of the United Kingdom, having been 7744 in 1884, as compared with about 50,000 in England and Wales, and over 18,000 in Scotland. The same characteristic appears in the numbers of passengers carried relatively to area and population. Although Ireland has both a larger area and a larger population than Scotland, the total number of passengers carried on the Irish lines in 1884 was only about one-third of that carried on the Scotch lines. Put in another way, it appears that, in the year 1884, 23 passenger journeys were made for every inhabitant of England and Wales, 14 for every inhabitant

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of Scotland, and only 4 for every inhabitant of Ireland. It might be argued from these figures that the people of England and Wales travel about six times as much as the Irish, and those of Scotland three and a half times as much; but it is possible that in Ireland the average length of journey will be greater than in either of the other two countries, where it is now so largely the custom for the population of large cities to travel daily to and from their business in order that they may enjoy the benefit of a more wholesome atmosphere than they can have "in populous city pent."

In Ireland, the working expenses are considerably higher, relatively to the gross receipts, than in either of the other two divisions of the kingdom. Out of every £100 of gross earnings in 1884, £53 went for working expenses in England and Wales, £51 in Scotland, and £56 in Ireland. Moreover, it is important to observe that in Ireland a larger proportion of the gross income has been applied to working expenses within the last few years, the proportion of the gross receipts so absorbed in 1869 having been only 51.6 per cent.; in 1876, 53.6 per cent.; and in 1880, 54.4 per cent. It is certainly not a healthy state of things to find the working expenses run away in this manner with a continuously increasing proportion of the gross earnings, especially when the tendency of both English and Scotch lines has been of an opposite character, and when the expenses of maintenance and working generally have been reduced, as we have elsewhere shown them to have been. The explanation is, of course, to be found in the diminished gross revenue per mile of line open.

So far as the returns of the employment of rolling stock are concerned, there is no reason to doubt that the Irish railways are administered quite as economically as, if not more so than, those of the sister countries. The average annual earnings per locomotive engine employed in 1884 was £4810 for England and Wales, £4500 for

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Ireland, and £4430 for Scotland. When we come to consider passenger traffic *per se*, the difference in favour of Ireland is still more marked. The average gross earnings per passenger vehicle used in 1884 was £875 for Ireland, as compared with £800 for England and Wales, and £660 for Scotland. There is no possibility of instituting a similar comparison in regard to goods traffic, because in Ireland, as in England and Scotland, a great many wagons are the property of private traders, and the numbers returned as belonging to the railway companies would, therefore, quite fail to give a clue to the average tonnage carried, or the average sum earned, per wagon employed.

There is still another item of expenditure in which the comparison comes out as specially favourable to Ireland. Between 1869 and 1874, the higher cost of materials and labour caused a great increase of expenditure on all the railways of the United Kingdom. In the case of England and Wales, the rise was from £1582 to £2316 per open mile of railway, and from 31.38d. to 38.52d. per train-mile. In the case of Scotland, the average expenditure for the same period rose from £914 to £1314 per open mile of railway, and from 27.25d. to 34.10d. per train-mile. On the Irish railways, the expenditure per open mile rose from £519 to £679, and per train-mile, from 31.21d. to 36.61d. Since 1884, there has been a partial return to the old rates of expenditure in all three countries, but in Ireland to a greater extent than in either of the other two, *per mile of railway open*, the figures having been as high as £679 in 1877, and as low as £620 in 1884; while the English lines only fell, within the same interval, from £2289 to £2287, and the Scotch lines from £1307 to £1278. Per train-mile, the expenditure for the three countries comes out somewhat differently, England and Wales falling from 36.26d. to 31.98d.; Scotland from 32.83d. to 28.76d., and Ireland from 35.61d. to 31.69d., as between 1877 and 1884. It will be noted, however, that whichever test is applied, Ireland does not come out badly.

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There are some historical aspects of the Irish railway problem that demand consideration, as differentiating it from that of either of the sister countries, and exercising a large amount of influence alike on the present condition and the future prospects of the system.

The condition of Ireland has at various times caused the attention of Parliament to be directed to the prosecution of public works in that country, and a large system of inland navigation has been executed there mainly out of Imperial funds.

In 1836, the question of the construction of railways in Ireland was brought forward by the Government.

A Royal Commission was appointed at the end of that year, and renewed in 1837, for the purpose of considering a general system of railways for Ireland, and the best mode of directing the development of this new means of intercourse to the channels where the greatest advantage might be obtained by the smallest outlay, with a view to opening out the resources of the country.

The Commission made a very elaborate survey of the country, and recommended certain trunk lines of railways; but they proposed—

"That every effort be made to combine into one interest and under one management and control the whole of the southern system of intercommunication between Dublin and Cork, Limerick, Waterford, and Kilkenny, and that the northern line by Cavan—to Armagh at least—be treated according to the same principle, and considered as one concern."

Failing the necessary capital for the undertaking being raised by the public, the Commission suggested—

"That, to avoid the evil of partial execution, and to accomplish so important a national object as that contemplated in the completion of the entire system, we may look forward to a certain degree of assistance from the State—as great, at least, as has been given for the encouragement of other public works in Ireland, and on those

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grounds of policy which we believe have not been disputed, and on which it is, therefore, unnecessary for us to enlarge."

They, therefore, recommended—"That Government should advance by way of loan a considerable portion of the amount of the estimates at the lowest rate of interest, and on the easiest terms of repayment, to be secured by a mortgage of the works." Many landholders, they held, might be found to subscribe towards carrying into effect an object which, in addition to its importance as a national concern, cannot fail to benefit and improve their own properties.

As a further assistance in filling the subscription, the Commission suggested that powers might be given to the counties interested, as well as to corporate towns, to become shareholders to certain amounts—the Government in such case advancing the money on the security of presentments in the usual manner, and the return of such shares being available for the reduction of the county or other rates.

These proposals were accepted generally by the Government of the day, which adopted a series of resolutions thereon, specifically recommending that certain lines of railway should be treated as public works, and that for their execution the Treasury should be empowered from time to time to issue exchequer bills. As a condition of such aid, the rates of carriage were to be fixed by Commissioners under the control of Parliament.

Government interference was not, however, favourably regarded, and these proposals were, therefore, finally dropped.

Meanwhile private companies took up the work of Irish railway construction, aided by occasional advances of money from the Consolidated Fund.

The first of these advances was made to the Dublin and Drogheda Railway in 1842. In 1847, a further issue of £620,000 was made to the Great Southern and Western, and one or two other companies. In 1849, an issue

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of £500,000 was made to complete the line of the Great Western Railway of Ireland. Subsequent advances have been made from time to time, although not of late years.

There is another important point in respect of which Irish railways are in a different category from either English or Scotch. In the earlier history of the system, the Government encouraged two gauges in England, and made a third, which agreed with neither of the other two, compulsory in Ireland.

By this arrangement the railways in Ireland have been deprived of all the advantages they might have derived from the use of engines and rolling stock from English lines. As the Royal Commission of 1867 pointed out, the carrying power of a railway, as well as the cost of its construction, increases in some proportion to the width of its line, and consequent magnitude of its trucks and engines; and the cost of some Irish railways has by this enlarged gauge been rendered compulsorily more expensive than that of English railways of the same character, although the traffic must necessarily be much less.

The multiplication of small railway companies in Ireland, and the generally unsatisfactory character of the system as regards financial results, has led, from time to time, to proposals being made for its acquisition and administration by the State. The advocates of such a policy have invariably pointed to the necessity that existed for providing additional facilities for the development of Irish resources, and the great difficulties in the way or raising capital privately for that purpose.

There scarcely appears to be any room for doubt that the industrial development of Ireland has been greatly retarded by the want of proper railway facilities. The country is not without considerable mineral resources. It is said to contain deposits of sulphur, iron, tin, and zinc ores. Professor Sullivan, who had inquired into the prospects of these several resources, informed the Royal

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Commission of 1867, that the railway charge for the transport of sulphur ore from the Vale of Avoca to Kingstown—a distance of only 39½ miles—was 50 per cent. on its actual value. The same authority stated that the zinc-mines of Nenagh would have sent out three times the quantity of mineral if they had only got proper freights from the railways. Many similar cases could be cited. It has been the same in reference to passenger traffic. Evidence was given to show that, on account of the high passenger fares charged, the peasantry preferred either to walk, or to hire a car, in which ten men might travel as many miles for 3s. or 4s. Since 1867, this condition of things has been somewhat improved, but even yet the Irish people, as we have already shown, do not use their railways to anything like the same extent as the English or Scotch.

The question of Government control of Irish railways was considered by the Royal Commission of 1866, which, after expressing the opinion "that it is inexpedient at present to subvert the policy which had hitherto been adopted of leaving the construction and management of railways to the free enterprise of the people, under such conditions as Parliament may think fit to impose for the general welfare of the public," added that "there is not sufficient reason for excepting Ireland from this general conclusion; but as it has been the established policy to assist railways and other public works in Ireland, we recommend that when Parliament thinks fit to make advances to Irish railway companies, the money should be lent for a fixed period of considerable length, so as to enable the company to develop its resources before it is called on for repayment." The Commission held, however, that advances should not be made to the Irish railway companies as a condition of reducing their rates and fares; but that, as the railway companies had the best opportunities of judging whether rates can be reduced so as to be recuperative within a reasonable time, they

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should be left to carry out such experiments at their own risk.

The effect of the advice given by the Commission of 1866, and of such other special consideration as Parliament has given to the subject from time to time, has been to leave the railways of Ireland on practically the same footing as those of England and Scotland, with only this difference, that they are exempted from Government duty. Their development, however, as we have already seen, has been much less rapid than that of the systems of the sister countries, and until a more stable Government has been established, this will probably continue to be the case.

One of the first acts of the present Government was to appoint a Commission to inquire into the extent and character of the resources of Ireland in reference to industries, railways, &c. It is more than probable that the labours of this Commission will throw a good deal of light on the existing situation, and may induce measures calculated to ensure its amelioration.

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CHAPTER XXVI.

RAILWAYS COMPARED WITH CANALS.

WITHIN recent years, prominent attention has been directed, in most of the leading countries of the world, to the comparative merits of railways and canals as means of transport. Upon such a subject it might reasonably be supposed that there could be little scope for any great difference of opinion and experience. The elements involved in transportation are, in the great majority of cases, ascertainable with precision. The conditions being given, as they generally can or ought to be, the difference of cost, as between one system of transport and another, should be capable of being formulated with the greatest exactness. And yet there is no phase of the great railway problem that is involved in greater obscurity, or in reference to which the opinions of experts, and the practice and legislative sanction of different countries, are more at variance. In the midst of so much incertitude and conflict, it is by no means a simple matter to disinter from the great mass of evidence that is available on this point the true and essential bearings of the controversy; but the question is of such urgent importance, that it is, at any rate, worth while making an attempt to solve it.

The conditions of the problem may be stated in a very few words. In so far as the general public is concerned, they may be thus expressed:—

1. Are canals capable of affording, in a general way, a cheaper means of transport than railways?

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2. If they are so capable, what is the difference of cost, and at what price can it be purchased?
3. If canal transport is the more economical, are there any serious countervailing disadvantages or inconveniencies, calculated to militate against its adoption?
4. To what extent have different countries taken advantage of canal transport in competition with railways?

To begin with, there are no two cases, within our knowledge, in which the cost of canal transport has been put at the same figure. Upwards of fifty years ago, when canals were the main arteries of communication for heavy traffic, the cost of haulage for slow boats was calculated at 0.18d. per ton per mile; for fly boats, at 0.5d. per ton per mile; and for swift boats, travelling at ten miles an hour, at 3.5d. per ton per mile.[1] When, however, the cost of boat-hire, &c., was added, the cost of transport was raised to 1.36d. for slow boats, to 3.5d. for fly boats, and to 13.25d. for quick boats, per ton of useful load per mile.

These appear to have been recognised for many years as the approximate bases of charges for canal transport.

The Duke of Devonshire's Commission of 1867 gives the following examples of the rates charged for the transport of certain descriptions of merchandise by canal and railroad at different dates:—

Articles.	By Canal, 1836.	By Railway, 1866.
	s. *d.*	*s.* *d.*
Undamageable iron . . .	25 0	15 0
Hardware	60 0	27 6
Sugar	40 0	21 8
Tallow	35 0	21 8
Drapery	70 0	40 0
Glass	70 0	37 6

[1] Macneil's tables, quoted in "Railway Practice," by S. C. Brees.

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For purposes of comparison, it may be useful to state, on the same authority, that the rates charged from Bristol to London by carriers in 1830, and by railway in 1866, were as under:—

Commodities.	Carriers, 1830, Rate per Ton per Mile.	Railway, 1866, Rate per Ton per Mile.
	s. *d.*	*s.* *d.*
Drapery	60 6	40 0
Hops	68 0	40 0
Oil	47 0	20 0
Tobacco	66 0	26 8

So far as they go, these figures unmistakably prove that the canals were accustomed to exact very much higher charges than the railways, while they were still enjoying immunity from the wholesome influence of competition, their charges amounting, in some cases, to more than double those of the railways in more recent years. In reference to this circumstance, however, it is necessary to remember that, at that time, the volume of traffic transported was inconsiderable. In 1836, the total quantity of mineral traffic available would probably not be more than one-fifth of what it is to-day.

But in canal transport, as in everything else, the last half-century has witnessed very considerable improvements. The waterways have been deepened, widened, and otherwise altered for the better, steam has largely taken the place of horse traction, and minor changes have tended to produce more economical working. Hence we have the following figures presented as the cost of transporting one ton of cargo one mile on different canal systems at the present time:—

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Statement showing Cost of Transport on Different Canals.

	Tolls.	Freight.	Totals.
	d.	*d.*	*d.*
French canals, average cost . .	0.16	0.22	0.38
Belgian canals, horse traction .	0.134	0.181	0.315
,, ,, steam ,, .	0.134	0.150	0.284
Alsace-Lorraine canals . . .	...	...	0.243
Mons to La Vilette . . .	...	...	0.28
Grand Junction Canal . . .	...	0.184	...
Traction only.			
Aire and Calder Navigation . .	...	0.083	...
Regent's Canal	...	0.081	...
Gloucester and Berkeley Canal .	...	0.062	...

From these returns, which are given on adequate authority,[1] it would appear that the average cost of canal transport, including both tolls and traction, varies from a minimum of 0.243d. to a maximum of 0.38d. per ton per mile.

It is somewhat doubtful whether these figures will compare favourably with the cost of working goods traffic on railways, where all the conditions of economy are properly studied and given effect to. The cost of working goods traffic necessarily varies very much, according to the locality, the amount of the traffic, the character of the gradients, and other determining considerations, so that it will hardly be found on any two railways to amount to precisely the same sum. Nor are we in possession of sufficient *data* to justify us in dogmatising either upon the actual average cost, or upon what it ought to be. One authority declares that the traffic that is best adapted for canal transport—minerals and other heavy commodities—is generally carried upon railways at a dead loss.[2] Another holds that such traffic is the most remunerative of any on the great trunk lines.[3]

[1] Report of Select Committee on Canals for 1883, p. 241.

[2] Paper "On the Cost of Working Different Descriptions of Railway Traffic," *Proc. Inst. Mech. Eng.*, 1878, p. 184.

[3] "On Economy of Railway Working," *Ibid.*, 1879, p. 110.

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There is, perhaps, sufficient evidence of what the cost of working heavy traffic really is to remove it, as to its main characteristics, from the region of controversy.

In 1865, the ascertained cost of working mineral trains on three of the principal English railways was stated to be:[1]—

Great Western	2s. 7.8d. per train mile.
Great Northern	2s. 6.6d. „ „ „
South-Eastern	2s. 10.7d. „ „ „

If the train is assumed to consist of 200 tons of live or paying load, the cost would amount to—

0.16d.	per ton per mile on the Great Western.
0.15d.	„ „ „ Great Northern.
0.17d.	„ „ „ South-Eastern.

And if we double these figures, in order to make adequate provision for the return empties, we shall have 0.32d., 0.30d., and 0.34d., respectively, as the total cost of transporting mineral traffic on English railways, including rates and taxes, bad debts, insurance, and all other items.[2]

It is true that in none of these cases is the average live load stated, but it is not too extravagant a figure to put it down at 200 tons. If larger loads are carried, the cost of transport per ton will be proportionately less.

These figures receive full and recent corroboration from a high authority. Sir James Allport states that on the Midland Railway the rule is to give 42 trucks, carrying 336 tons of minerals, to a train,[3] and that the expenses of working the railway, *including everything*, would amount to an average of 2s. 6d. per train-mile. According to these figures, the cost of mineral transport on the Midland Railway should not be more than 0.089d. per ton per mile; and if we again double this

[1] Report of the Duke of Devonshire's Commission on Railways.

[2] The items that compose the cost given for the Great Western are set out in detail by Sir Daniel Gooch.

[3] Report of Select Committee on Canals.

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item in respect of return empties, we have a total cost of only 0.178d. per ton per mile, or about *27 per cent. less than the minimum cost shown for canal transport.*

Another authority[1] has calculated, on what appears to be fully adequate *data*, that on the Great Northern Railway the cost per ton per mile of working mineral traffic—assuming twice the average cost per train-mile, and 300 tons average net load—is not more than 0.2385d., which, however, is 34 per cent. more than the average brought out by Sir James Allport's figures.

If we examine the more exact and detailed returns of the railways of the United States, we shall find that they go a long way in the direction of confirming the *data* which we have already ascertained to represent the cost of working mineral traffic in the United Kingdom. The cost of transporting goods traffic generally—not minerals alone—on the principal American railroads, is stated to have been, in 1880, as under per ton per mile:[2]—

	d.
New York Central	0.27
Lake Erie and Western	0.26
Pennsylvania	0.23
Pittsburg, Fort Wayne, and Chicago	0.26
Boston and Albany	0.51
Lake Shore	0.21

—while, according to another authority,[3] the average cost of transport over the whole of the 291 millions of tons of freight carried in the United States in 1880 amounted to 0.38d. per ton per mile, being, curiously enough, exactly the sum ascertained and stated elsewhere to have been the average cost of transport on the canals of France as a whole.[4]

[1] Mr. Price-Williams on "Economy of Railway Working," *Proc. Inst. Mech. Eng.*, 1879, p. 110.

[2] Poor's Manual of the Railroads of the United States for 1881.

[3] Report of the Tenth Census of the United States (1880), vol. iv. p. 11.

[4] "Rapport fait au nom de la Commission d'Enquête sur les chemins de fer, et les moyens de transport," &c. By M. Krantz.

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So far, then, as we have been able to adduce evidence, there appears to be little advantage, in point of the actual cost of transport, in favour of canal navigation. This does not, however, mean that railways do not really impose heavier charges than canals on the traffic committed to their care. There is this very important difference between the two systems, so far as England is concerned, that while the canals have not cost more than £5000 to £6000, railways have, rightly or wrongly, involved an average expenditure of about £50,000 per mile; so that, *on the same volume of traffic, the railways would require to make a considerably heavier charge in order to obtain the same financial return.* Hence it is an undoubted fact that the average charges on English railways are considerably heavier than on English canals over the same distances. Not only so, but where railways have acquired possession of canals, they have usually levelled up the canal to the railway rates, and have seldom or never levelled down the railway to the canal rates.[1]

It is not, however, entirely a question of the comparative cost of transport on railways and canals. The truth is, that at the present time canal competition scarcely exists in England. There is no exact return of the extent of canal navigation in the United Kingdom, but, according to returns made to the Canal Committee of 1883, there were then about 4000 miles of such navigations, of which 1333 miles were guaranteed and owned by railway companies, 188 miles were derelict, 119 miles were converted into railways, 1445 miles were under independent ownership, and 927 miles were controlled by public trusts. In almost every case

[1] Many proofs might be cited of this fact. The Report of the Select Committee on Canals (1883) states (p. 253), that on canals between Birmingham and London, under railway control, the average rate per ton per mile is 1.40d., whereas on the Grand Junction Canal, which is exempt from railway control, the rate is only 0.35d.

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of an important through route, the railways had secured some link in the navigation which enabled them to impose bar tolls and throttle the competition. Not only so, but the canals of the United Kingdom have generally been very much neglected, and allowed to fall out of repair. Then, again, the "break of gauge" is so frequent that the utmost difficulty is experienced in making practical use of the canals, except for the smallest craft, and in more than one instance it is found necessary to break bulk, in order to secure the canal transport of traffic throughout a particular route. The advocates of canal transport suggest that Parliament should take steps to amend this condition of affairs. As to the remedy to be applied there are, however, very conflicting opinions. Some recommend that Parliament should take the canal system into its own care, and expend an average of £12,000 a mile in bringing it up to a necessary condition of efficiency.[1] But there are manifest objections to this course. The State could hardly place itself in direct competition with railways as a public carrier, and if it attempted anything in this direction at all, it would certainly be bound to acquire the railways as well as the canals, in which case the railways might be managed in such a way as to render canal competition unnecessary. Then, again, the canal system might not be able to carry at such low rates if the average capital were raised from £5000 to £17,000 per mile, even if the difference of capital cost were readily obtainable, which is not by any means certain.

At the same time, it is impossible to deny that the relations of the railways to the canal system and to the public, as traders, are not by any means satisfactory. It is of great importance, in the interests of trade and com-

[1] Mr. James Abernethy informed the Select Committee of 1883 that it would require £12,000 per mile to bring the Leeds and Liverpool Canal up to the efficiency of the Aire and Calder.

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merce, that competitive routes should, as far as possible, be maintained where they are already in existence. Now, there have been, or, at any rate, there were until quite recently, competitive railway and canal routes between London and Liverpool, Hull, the Severn ports, and South Staffordshire; between Liverpool and the Severn ports, Hull and South Staffordshire; and between South Staffordshire and the Severn ports, Hull, Leeds, &c.[1] By keeping open these canal routes, there is an effectual check placed on railway monopoly and rapacity—a check which is furnished, as regards very many of the principal ports of the country, by the coasting trade, but which is manifestly of the first importance as regards the rest of the country, when we remember that there is no competition whatever at probably three-fourths of the 6000 stations in the United Kingdom.

A discriminating writer in the *Edinburgh Review* remarks, in reference to the competition of canals and railways for heavy traffic, that "the whole policy of the railway boards towards the canals has been based on the principle of rendering fair competition for such traffic as was water-borne before the construction of railways impossible. Had the railway been essentially a cheaper and better medium for mineral traffic, the canals would have been let alone. The public would soon have found out the truth, and the traffic would have followed its best natural channel, whichever it was." It is only necessary to observe what are the facts of the case, to see that railway directors were instinctively aware that the canals, if let alone, would successfully compete for a large share of traffic. Out of 4135 miles of inland navigation in the United Kingdom, 1716 miles have been actually purchased by railway companies.[2] In other cases a certain

[1] Details of these several routes and of their ownership are given in the Report of the Select Committee on Canals (1883), p. 212.

[2] These figures do not agree with those given on p. 404 from the Canal Committee's Report.

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annual payment has been made to canal companies, on the condition that certain tariffs should be adopted. In yet other cases the railway companies have impeded the operation of canals by reducing their own charges, generally, to a minimum, but at the same time raising them to a maximum on any points where by so doing they can check great lines of water communication.[1]

"If we count the cost at which the railway companies have forced upon their lines the amount of mineral traffic for which they now receive some 12½ millions sterling per annum gross income,[2] we shall find good reason for the opinion that the country would have been in a more prosperous state, or, at all events, that railway proprietors would have been far more amply remunerated than is now the case, if the Legislature had insisted on the performance of the conditions originally prescribed in order to prevent monopoly. In the first place, the purchase of 1716 miles of canal cannot have cost less than six millions sterling. The guarantees and rents paid when the lines of canal have not been actually purchased are not easy to be ascertained. The Leeds Canal alone is said by M. de Franqueville to receive nearly £40,000 per annum from the North-Western and Lancashire and Yorkshire Railway Companies, by way of bribe to keep up its rates. For the destruction or command of the canal traffic, it is probable that the net revenue of the railway companies, including interest on actual expenditure, is diminished by more than half a million per annum."

In the earlier years of the present century, canals were generally prosperous, and many of them returned extraordinary profits. In 1825, a Birmingham canal was yielding cent per cent. For about half a century, the shareholders of the Old Quay Canal Company at Manchester received as dividends, every two years, a

[1] Du Régime des Travaux Publics, tome ii. p. 294.

[2] This applied to 1875; the mineral traffic now yields to the railways of the United Kingdom close on 16 millions sterling a year.

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sum equal to the original outlay, and at one time the £70 share sold for £1250, or nearly eighteen times its par value. For more than twenty years, the Duke of Bridgewater's Canal returned a net income of £100,000 per annum. So late as 1833, the Coventry Canal paid 32 per cent.; the Oxford, 34 per cent.; the Stafford and Worcester, 34 per cent.; the Mersey, 37 per cent.; the Erewash, 47 per cent.; and the Loughborough, 134 per cent. per annum. Like railways, at the present time, canals had at one time a virtual monopoly of the conveyance of heavy goods, and maintained, as we have seen, a very high tariff of rates, until they were compelled by railway competition to come down to lower terms. In their earlier days, also, railways were handicapped in their competition with canals by the fact that Parliament granted compensating tolls to railways, while they were denied to canals.

We shall now endeavour to ascertain how far canal navigation competes with railways in other countries.

According to returns that have been published very recently,[1] it would appear that there were 7825 kilometres of lakes and rivers, and 4713 kilometres of canals, in France at the end of 1884. This made a total of 12,538 kilometres (9900 miles in all) against a total of 18,553 miles of railway. The total quantity of merchandise of all kinds carried on the lakes, rivers, and canals in that year amounted to 21 millions of tons, against 94¼ millions of tons carried by the railways. The total number of tons carried one mile on the lakes, rivers, and canals was 1501 millions, of which 813 millions, or 54 per cent. of the whole, were carried on canals alone. The average length of lead on the canals was 68 miles. On the French railways, for the same year, 94¼ millions of tons were carried over 7044 millions of miles, giving an average of 75 miles for each ton transported. The rivers and canals, therefore, had

[1] Bulletin du Ministère de Travaux Publics, Mars, 1886, p. 216.

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about 20 per cent. of all the goods traffic carried in France on these ways of communication and the railways together. It is impossible to compare this figure with returns for the United Kingdom, inasmuch as the traffic carried on British canals is not ascertained.

These figures are sufficient to prove that canal traffic is a very considerable item in France, although very far from equal to that of railway transport. It is, however, chiefly as a means of imposing a check upon the railway system that the French Government attach importance to the development of their canals, and for this purpose they have expended large sums within recent years. Up to 1870, the total amount expended on rivers and canals in France amounted to 41½ millions sterling. In 1874, it was calculated that 33½ millions would be required to complete the inland water communications of France, and in 1878 it was recommended by a Commission appointed by the Chamber of Deputies, that the State should sanction the expenditure of 40 millions sterling for this purpose. The French railway rates are, however, exceptionally high, as Continental rates go, so that France has perhaps more need of canals as a set-off to railways than any other European country.[1]

But if we would ascertain what railroads are really capable of achieving as against canals, we must go, not to Continental Europe, nor to any part of the United Kingdom, but to that much wider field of transportation operations embraced within the United States.

The total cost of construction of the 2515 miles of canals operated in the United States in 1880 was returned at a little over 170 millions of dollars, being an average of over 67,000 dollars, or £14,000, per mile. The canals that are still being worked have involved a considerably higher capital cost than the canal system of the

[1] Some of the French canal rates are extremely low. Coal is carried from Saarbruck to Paris (342 miles) for 0.28d. per ton per mile, and iron ore from Nancy to Burbach (87 miles) for 0.33d. per ton per mile.

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country as a whole. The gross income of the operated canals in the Census year 1880 was 4,538,620 dollars, or 1803 dollars (£375) per mile, as compared with an average income of over £1320 per mile of railway opened in the United States in the same year. The total expenditure on the same canals for the same period was 2,954,156 dollars, being about 1180 dollars (£241) per mile, leaving a net revenue of only 623 dollars (£129) per mile. The total freight traffic carried on the United States canals in this year was 21,044,292 tons, being an average of rather over 8000 tons per mile, as compared with a total of 291 millions of tons, or an average of 3327 tons per mile moved on American railroads in the same year. It will be seen, therefore, that of the total freight traffic on the railroads and canals of the United States in 1880, the canals carried about seven per cent., while the railroads of the country as a whole carried the remaining ninety-three. The question not unnaturally arises, Is there anything inherent in the American canal system that renders it unable to compete with railway transportation, where they are both carried on side by side?

To solve this problem, it would be necessary to go into details at very considerable length. The canals and the railroads of the United States have had a long and a fierce struggle for supremacy. The canals had the high sanction and support of the several States, being, for the most part, State property, and carried on under State administration. The railways, on the contrary, have been the outcome of private enterprise, but enterprise quite untrammelled as to its scope and movements, and free to adapt itself to the ever-varying requirements of the traffic that it aspired to serve and to secure. The result has been an unqualified triumph for the railway interest, and the canals, if they have not been placed entirely *hors de combat*, are every year showing a diminished relative extent of traffic, notwithstanding

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enormous concessions in the matter of freight charges, in which, indeed, they compare very favourably with the railways. The extent of these concessions may be appreciated by the fact that the average toll taken per ton carried on the New York State canals fell from 1.24 dollar in 1840 to 0.17 dollar in 1880.[1]

The records of American transportation prove, however, that the merits of the controversy as between railways and canals are not to be settled by the mere comparison of freight rates, a fact which has long been known in some other countries, and more than suspected with reference to England. In other words, unless low rates of freight are coincident with ample facilities, and especially with celerity and reliability of transport, they are not necessarily the controlling factors.

If we desire to establish this proposition, we need not go farther afield than the New York State canals, which have invariably quoted lower rates than the railroads of the same State. In 1873, the average rate per ton per mile on the canals was .887 cent, as compared with 1.573 cent on the New York Central, 1.454 cent on the New York, Lake Erie, and Western, and 1.415 cent on the Pennsylvania railroads. And yet we find that, between 1873 and 1883, the traffic carried

[1] *Statement showing the Tonnage Moved on the Canals of New York State at Different Periods, the Tolls Paid thereon, and the Average Toll per Ton.*

Years.	Tonnage Carried.	Total Tolls.	Average Toll per Ton.
	Tons.	dollars.	dollars.
1840	1,416,046	1,775,747	1.24
1845	1,977,565	2,646,181	1.34
1850	3,076,617	3,273,896	1.06
1855	4,022,617	2,805,077	0.70
1860	4,650,214	3,009,597	0.65
1865	4,729,654	3,839,955	0.81
1870	6,173,769	2,611,578	0.42
1875	4,859,958	1,590,032	0.33
1880	6,457,656	1,155,419	0.17

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on the New York State canals fell from 6,364,782 tons to 5,664,056 tons, while that of the three railway companies named rose thus:—

The New York Central, from 5,522,000 to 10,892,000 tons.
The New York, Lake Erie, and Western, from 6,312,000 to 13,610,000 tons.
The Pennsylvania, from 9,211,000 to 21,674,000 tons.

Again, a great deal of the traffic carried on these railroads and canals takes the form of grain for export. The average rate for the transport of wheat from Chicago to New York, fell from 24.54 cents per bushel in 1868 to 6.60 cents in 1883–84—a reduction of 73 per cent. Over the same interval, the all-rail rates for the same journey fell from 42.6 cents to 13.0 cents—a reduction of 69 per cent.[1] But at the last-named date, the rail rates were 6.4 cents, or 98 per cent. above those by lake and canal. And yet the traffic has been leaving the canals, and cleaving to the railways! This, on the first blush, may seem a hard thing to understand. The real reasons are, that the railways give reasonable rates to begin with, they are not liable to be affected by weather, they deliver the grain in good condition, and they *can always be absolutely depended upon.*

It is, of course, possible that other countries may not be disposed to show the same apparent disregard of the element of low freight rates as the United States, although there is no reason to believe that the typical American would voluntarily or readily relinquish the opportunities afforded by the lower rates charged for canal transport, unless the difference were compensated for in other ways. But with a diminishing volume of traffic on canals, and an enormously increasing volume on railways, the former are losing their relative superiority even in the matter of greater economy.

Mr. Conder has made the following interesting calcu-

[1] Official Report on the Commerce and Navigation of the United States for 1884, p. 46.

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lation of the comparative cost of working railway and canal traffic in different countries, basing his estimate on the assumption of a traffic of 600,000 tons net per annum, and allowing 4½ per cent. interest on capital:[1]—

	Cost per Mile.	Interest.	Working Expenses.	Cost per Ton per Mile.	Cost per 100,000 Units.
	£	d.	d.	d.	£
Railways in United Kingdom	40,000[2]	0.68	0.53	1.21	504
,, ,, England only .	46,800[2]	0.78	0.53	1.31	587.5
Canals in England . .	6,560	0.11	0.26	0.37	154
Railways in France . .	25,780	0.44	0.42	0.86	318
Canals ,, ,, . .	6,229	0.10	0.23	0.33	137
Railways in Belgium . .	26,403	0.45	0.49	0.94	392
Canals ,, ,, . .	redeemed	...	0.20	0.20	83.3
Steam colliers by sea . .	...	0.038	0.116	0.155	64.5

So far as they go, the foregoing figures appear to show very clearly and strikingly two important facts—the first that, *for the same amount of traffic*, English railways would require to charge a much higher rate than the railways of other countries in order to earn the same dividends; and the second, that, with the same amount of traffic, canals can afford to carry at nearly one-fourth of the amount required to compensate English railways for same service.

It will be observed, however, that a very great deal hangs upon the important qualification of the amount of traffic. As a matter of fact, the conditions in this respect are in no two countries alike, and as any such comparison must take the actual amount of traffic into account, figures that are based upon a hypothetical quantity cannot be strictly applied to the solution of the problem. For it is obvious that the amount required to pay a certain specified interest on a given capital will be the

[1] Report of the Select Committee on Canals, 1883, p. 233.

[2] These figures have been raised, since this calculation was made, to about £42,500 and £50,000 respectively.

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same, whether the traffic is large or small; and if we find that the proportion of the total cost of carrying traffic is reduced from three or four times that involved in the case of canals to just about the same figure as that of canal traffic, by reason of the very much greater quantity over which the cost is distributed, it is clear that the conditions of the question, as based upon an equally hypothetical figure, become entirely changed.

It has been calculated that the average cost of transport of all kinds of mineral and merchandise traffic in the United Kingdom is 1.10d. per ton per mile.[1] The total railway receipts from mineral traffic in 1884 amounted to £15,528,656. The total quantity of minerals carried in the same year on British railways amounted to 183½ millions of tons.

The question that it now concerns British traders to investigate is that of how far the cost of transporting this traffic would be likely to be reduced by an adequate system of canal transport. It would seem that for every tenth of a penny that they can save per ton per mile, as applied to the whole mineral traffic of Great Britain, they must withdraw £1,320,000 from the railway companies; and if the average rate of transport for mineral traffic could be reduced from the 1.10d.[3] to the .64d. per ton per mile ascertained by the Census authorities to have been the average charge for the transport of all kinds of merchandise in the United States in 1880,[2] the effect would be to place at the disposal of the heavy trades *about seven millions sterling a year that is now paid to the railways.* This surely is a result well worth striving for, if it is within the region of attainment.

England is already better provided with canals, so far

[1] Report of the Select Committee on Canals, 1883, p. 241. In other sections of this work, however, the average is taken at higher figures.

[2] Reports of the Tenth Census, vol. iv. p. 11.

[3] The mineral rates, however, will probably not equal 1.10d. per ton per mile, while the general traffic rates will be higher than that.

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as actual mileage or extent is concerned, than any other country in Europe except France, and she is ahead even of France in the extent of her canals relatively to area. The statistical position of the chief canal-owning countries is as under :[1]—

Statement showing the Mileage of Canals in Different Countries, relatively to Area and Population.

Countries.	Extent of Canals,[2] Miles.	Canal Mileage per 100 Square Miles of Area.	Canal Mileage per 10,000 of Population.
England . . .	4,332	7.4	1.7
Ireland . . .	775	2.4	1.5
Scotland . . .	354	1.1	0.9
France . . .	7,400	3.6	2.0
Belgium . . .	1,254	11.0	2.48
Italy . . .	5,428	4.7	1.9

It is evident, then, that if canals are a desirable possession, England is not destitute of such resources. But in their present condition the canals are almost useless, and it will require not a little energy and enterprise, not to speak of heavy outlay, to bring them up to an adequate standard of efficiency. It is for the traders of this country, and especially those concerned in the great mineral industries, to determine whether, and how far, this endeavour shall be made.

[1] Report of the Select Committee on Canals for 1883.

[2] The mileage given for the United Kingdom in this column is considerably in excess of that already quoted (on the authority of Mr. Abernethy) at p. 404. This is probably due to the inclusion, in the larger figure, of canalised rivers not provided for in Mr. Abernethy's calculations.

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CHAPTER XXVII.

EXTENT AND CONDITIONS OF INTERNAL COMMERCE.

THE commerce of a country naturally divides itself into two categories. The first, and the most readily appreciable with reference to its value and volume, is the *external*, or foreign commerce. The second is that enormous business which is carried on between the several divisions of the country itself, and is commonly spoken of as the *internal* commerce.

It is not easy to classify these two different categories on precisely parallel lines. The Board of Trade and the Custom-house returns show the total declared value of exports and imports, but there are no correspondingly full returns of quantity. On the other hand, the railway returns afford details of the quantities carried on railways, but no *data* are afforded as to the value.

There is this further difference to be noted, that whereas the returns of external commerce may, and indeed generally do, specify the approximate value of export trade, it is practically impossible to furnish exact returns of the internal commerce of any country, whether as regards value or as regards volume.

The reason for this distinction is not far to seek. The external commerce of a country like England must necessarily be transported by water, and records are kept of all vessels arriving at or sailing from our ports, together with their cargoes and their destinations; but with internal

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commerce such exact and complete returns would be impossible, since there are not, and could not very well be, any record of the market value of the traffic carried over our public highways, while the State has not as yet made any attempt to procure statistics of the business carried on by canal companies and on rivers and lakes.

It is, therefore, a difficult matter to make a comparison of external and internal commerce that would fairly represent the true facts of the case—all the more so, in a country like our own, where there is a transportation business carried on between different districts; where there is much more of interdependence than in newer countries; where bulk is often broken, and the same traffic, being carried over several different lines of railway, is frequently and unavoidably duplicated in official returns; and where the internal commerce and the external commerce are very largely composed of the same elements.

The subject is, however, one of such extreme importance, that it may not be altogether unavailing if we attempt to follow it in some of its more obvious and essential aspects.

The internal commerce of a country necessarily embraces much more than its commerce with other lands. It embraces not only the commodities that are transported from the place of production to the port of shipment, and the commodities that are imported from the port of receipt to the centres of distribution, but it also includes the very large traffic that is carried on between the different districts of the country itself, and with regard to which there are not, and cannot, in the nature of the case, be, any very considerable degree of accuracy attainable.

As an example of this fact, the special case of coal may be cited. Over 160 millions of tons of coal are annually raised in the United Kingdom. The whole of this quantity must necessarily figure in the internal commerce of the country, since it must all be moved from the place of production to the place of export or consumption.[1]

[1] There is, of course, a certain quantity consumed at collieries, but it may practically be disregarded.

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But not more than about one-eighth part of the whole appears in the returns of external commerce, since only about that proportion is exported. In this case, therefore, the ratio between the two is as one to eight.

The case of agricultural produce is an even more striking one. The agriculture of England is practically excluded from returns of external commerce, since we do not export any agricultural produce worth speaking of. But we know, nevertheless, that the great bulk of our home-grown produce is not consumed on the spot where it was raised, and that it must, therefore, figure in the returns of internal commerce. The exact volume of this produce has probably never been accurately computed. We have periodical returns of the quantities of wheat, barley, and oats sold in home markets, and, for the year 1884, these amounted to about 6½ millions of quarters. But this only forms a very small proportion of the total agricultural produce of the country, which includes a hundred other commodities besides grain, and which Sir James Caird, some years ago, calculated to be worth not less than 250 millions sterling.[1]

As with coal and agricultural produce, so with most other commodities that enter into the economy of our everyday lives. The internal commerce must needs greatly exceed the external, which it includes and involves; but how much the one surpasses the other in amount or value it is difficult to calculate. This difficulty, great at any time, is much increased in a country like our own, whose interests are so widely ramified and far-reaching, whose manufactures are so varied and important, and whose circumstances necessitate so great an interchange of commodities as between one district and another.

It is this enormous internal commerce that has called our railway system into existence, and has made it what

[1] This figure will not apply to the present time. It is probable that, since prices have fallen so greatly all round, about 180 to 200 millions will be nearer the mark, if the value is even so much as that.

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it is. To the railways alone, this commerce pays tribute to the extent of about 38 millions sterling a year, towards which minerals furnish 15½ millions, general merchandise about 21 millions, and live stock about 1¼ millions. What percentage this sum will represent on the total value of the commodities transported it would be impossible to determine with accuracy. It may be 5, 10, or 15 per cent. It is not likely to exceed the latter, and may not equal the intermediate figure; but if it is put at 10 per cent. of the total, we should find that the value of our internal commerce transported by rail amounts to 950 millions a year.

The commerce moved on our rivers and canals cannot be computed even in this rough-and-ready fashion, since we have absolutely no record of either the quantities moved or the gross receipts derived from their movement. But we do know that the total net profits from canals in the United Kingdom amounted in 1884 to £3,365,000; and if we assume that this amounts to about 5 per cent. on the gross earnings,[1] the further sum earned by this system of transportation must be considerable. Practically all the traffic carried on our canals is of relatively small value; in proportion to its weight and bulk, it will be much under the value of the traffic carried by rail; and, therefore, the percentage proportion of its total value that will go for transport will be much higher than in the case of railway-borne traffic, regarded as a whole. If we assume that the canals took 10 per cent. of the actual value of the commodities they transported, it would follow that the total amount of such value would be 170 millions; but if they took 20 per cent., which is probably as near the mark,[2] the value of the whole would be brought

[1] It is probable that the net profits will be under this figure. On the railways of the United Kingdom, as a whole, they amounted, in 1884, to 4.27 per cent.

[2] The total estimated value of the coal and metals (including the ores used in their production) in the United Kingdom in 1884 was 64 millions. Of this, the railway companies received 15½ millions for transport, being over 24 per cent. of the total estimated value.

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down to 85 millions, and the gross value of the internal transport by rail and canal would be raised to just over 1000 millions sterling.

These figures may, to some considerable extent, be tested and confirmed by others that are less purely hypothetical. The internal commerce of the country is composed of three principal items, viz.:—

Exports and imports, valued at . . .	686 millions
Home agricultural produce, put at . .	200 ,,
Minerals and crude metals	64 ,,
Totals . . .	950 millions

Now, the whole of this will require to be transported for greater or shorter distances, and the larger part of it will be transported by rail or canal. Much of it, of course, will be delivered at the place of consumption, without the agency of either of these means of transport, as, for example, in the case of the imports into the cities of London and Liverpool, which are mainly delivered at the doors of consumers' houses by the more modest medium of rolley or dray. But, to compensate for this difference, we have the whole of the rest of the local internal commerce, exclusive of minerals and agricultural produce, to deal with. There is, besides, a great part of the latter items to be reckoned twice over. Metals are reckoned both as metals and as the ores from which they have been smelted; and wheat, both as grain and as flour. These several elements would appear not only to go a long way towards making up the difference as between the official, or partly official, values found for the main constituents of our internal commerce, and the extent of that commerce as tested by the traffic returns of our railways and canals, but they also unquestionably point to a difference, tending to increase the value of that commerce, which still remains to be explained and accounted for.

This difference, whatever its amount, is to be sought for in the returns of our coastwise trade. In 1884, the

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tonnage of the vessels that entered and cleared from the ports of the United Kingdom with cargoes amounted to 50,866,000 tons. There are no means of adequately testing the value, or even the tonnage carried, of the commodities thus transported; but if we assume that each ton of shipping entered and cleared represents only one ton of produce of one kind or another, the volume of traffic conveyed between the different ports of the United Kingdom in 1884 would be over fifty millions of tons. What the value of this might be we are quite unable to judge; but if it is put at the low sum of £5 per ton, we should have the 1000 millions of value carried on our railways and canals raised to 1250 millions sterling.

For the traffic that may be moved equally well by land or by sea, there has long been a strong competition between the railways and the shippers engaged in the coasting trade, and the conditions of the development of this rivalry form one of the most interesting chapters in the history of the railway problem.

The United Kingdom is almost unique among the leading countries of the world in this respect, that it is a "sea-girt isle," surrounded on every side by ports that afford ready access to all parts of the kingdom, and impose a salutary check on the otherwise monopolist powers of the railway system. Hence it is invariably found that wherever there is a choice of routes to the same destination, *i.e.*, by land and by sea, the railway rates are considerably under those charged for transport between any two points that have not the advantages of competition by sea.

It was believed by many sanguine railway authorities, and is so still, that the railway would always beat the sea, not so much in respect of econony of transport, as in respect of the facility and regularity of its service, and the means which it provides for connecting intermediate points. But after a fierce competition, that has now lasted over

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many years, and the essential conditions of which are fairly well understood, the rivalry continues as strong, and apparently as likely to last, as ever.

On the first blush, the conditions of this contest would appear to be vastly unequal. A railway can never compete with the sea on its merits—so far, at least, as economy of transport is concerned. It is calculated, on authority that we are content to accept for the present purpose,[1] that the cost of transport per unit of one ton of cargo conveyed one mile is 0.155d. by a steam collier, and 0.208d. on the average of British railways. According to this, then, the cost of transport by railway is 34 per cent. more than that of transport by sea. But this difference is usually compensated by the fact that many commodities, being perishable, require to be carried with great despatch; while many more, that would otherwise probably be carried by sea, would first require to be carried by rail to the seaboard, and, to avoid the breaking of bulk thus entailed, they are transported direct by rail at very low, because competitive, rates of freight.

Under these circumstances, the railways and the coasting trades have not only been able to co-exist, but to show an almost equal rate of development. Between 1870 and 1884, the tonnage of the vessels entering and clearing from the ports of the United Kingdom in coasting voyages has increased from 36½ to 50¾ millions of tons, being an increase of nearly 40 per cent. Within the same period, the gross revenue of our railways has increased from 46 to 70 millions, or 52 per cent.; while the weight of goods carried has increased from 160 to 260 millions of tons, or 62 per cent. This comparison is, of course, not based on strictly parallel conditions; but all that is required is to show that the two systems of transport have made concurrent progress.

There is, however, a danger threatening the continued existence of this healthy, and, to the commerce of the

[1] Mr. Conder in the Report of the Select Committee on Canals, 1883.

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country, highly important, rivalry. That danger is, that the railway companies may become possessed of many of our principal ports and harbours, and use them, as they have used the canals, with a view to throwing all the traffic possible on to their own lines, and diverting it from the cheaper, if more cumbrous, system of transport.

That this is not an imaginary danger is attested by the action of railway companies in reference to harbour accommodation within recent years. The Great Western Railway has either become possessed of, or practically exercises absolute control over, the harbours of Plymouth, Llanelly, Bridgewater, Gloucester, New Quay, Porth-cawl, and Swansea; the North-Eastern Railway occupies the same position in relation to the harbours of Hartlepool, Middlesborough, and, though to a much less extent, of Newcastle-upon-Tyne and some smaller ports. So with the Lancashire and Yorkshire Railway, in reference to Fleetwood; the Midland Railway, in reference to Morecambe and Burnham (Somerset); the London and North-Western, in reference to Garston, Runcorn, and Holyhead; the Great Eastern, in reference to Folkestone; the Hull and Barnsley, in reference to Hull; the Furness, in reference to Barrow-in-Furness; the Brighton, in reference to Newhaven; the Cambrian, in reference to Aberdovey; the Great Eastern, in reference to Lowestoft; the Chatham and Dover, in reference to Queenborough; the North British, in reference to Burntisland; and the Caledonian, in reference to Grangemouth.

It is not suggested that these ports and harbours, some of which have been provided for the convenience and development of traffic at a large expenditure that was not otherwise likely to be met, have been acquired or constructed with any original intention of throttling the coastwise trade. It may even appear ungracious to hint at the possibility of such a result coming to pass, having regard to the outlay that railway companies have undertaken to adapt the ports within their jurisdiction to the require-

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ments of an increasing trade. But the railways have, after all, a peculiar relationship to the shipping interest. It is their obvious duty and interest to bring all the import traffic they can to the ports under their control, in order that they may secure its distribution among consumers throughout the districts which they severally traverse. But it is also, and no less, their interest to so manage their ports as to throw on to their own lines, and divert from sea transport, the traffic that is now in the hands of the coastwise shipping trade; and while they would not be likely to throw obstacles of any kind in the way of the former—that is, the *import* trade—they are not at all unlikely to impose disabilities that would be to the detriment of the coasting trade. It is scarcely necessary to add that, if such a policy were adopted, it would be greatly injurious to traders, the very breath of whose nostrils is now, in a great many cases, the facilities they possess in consequence of sea competition.

The remedy, however, is by no means easy. A great deal has been done by railway companies in developing harbour facilities that would not have been done but for their liberal and hearty co-operation. The Furness Company has spent over two millions on the docks at Barrow; the Brighton Company has expended about half a million at Newhaven; the Great Western has expended about £82,000 at Llanelly; the Lancashire and Yorkshire has laid out nearly a quarter of a million at Fleetwood; the North-Eastern has spent some hundreds of thousands at Hartlepool and Middlesborough; the Caledonian has expended £390,000 at Grangemouth; and the North-Western has laid out a quarter of a million at Garston, and about £300,000 at Holyhead. These are typical examples of what railways have done for the development of our harbours and docks, with results that have so far been highly advantageous to the several communities concerned.

To enact that railway companies should not in future

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have the liberty to acquire any existing ports and harbours, or to construct new ones, would be a drastic and perhaps unworkable remedy, as well as a gross interference with the rights of property. Parliament has, it is true, interfered to prevent the further acquisition of *already existing canals* by railway companies, but that is a very different matter. The presumption is that canals are acquired in order either that they should be converted into railways, or that they should be so managed as to put an end to their competition with the railways. But harbours have neither been built nor acquired for any such purpose, so that the two cases do not run on all fours. It would probably meet the threatened difficulty if Parliament made it obligatory on railways that own docks and harbours (as is now done with regard to the traffic carried on their own lines) to afford all reasonable facilities for the coastwise trade, and to impose dock and harbour dues within a certain fixed and reasonable maximum limit, as is now provided with reference to the charges made upon their own lines.

Of one thing we may be quite certain. The internal commerce of this country is an item worth struggling for. As time goes on, and as facilities multiply, the struggle will become fiercer and fiercer, not only as between railway and railway, but as between railways and canals, and, in a still greater degree, as between railways and the sea. If all three systems of transport are allowed ample elbow-room, English commerce may not have much to fear. The business of Parliament, we take it, is "to stand by and see fair."

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CHAPTER XXVIII.

EARLY ESTIMATES COMPARED WITH ACTUAL RESULTS.

THERE is no aspect of the cost of railway construction in the United Kingdom that excites such general remark and astonishment as that of the greater cost of construction, as measured by open mileage, than the railways of other countries.

This subject is so often referred to in discussions on the comparative circumstances of English and foreign railways that it may fairly claim to receive, as regards some of its specific elements, as much light as the somewhat intricate and difficult character of the problem involved will enable us to throw upon it.

The great increase in first cost in the case of English railways is not by any means a new characteristic. On the contrary, it is one of the very earliest that we can discover in an examination of the early records of the system.

In 1842, twelve years after the railway *régime* of the United Kingdom had been fairly inaugurated by the opening of the Manchester and Liverpool Railway, the following was the average cost per mile of some of the principal English lines:—

London and Brighton	£64,370
London and Birmingham	52,780
Great Western	55,330
Manchester and Leeds	59,800
North Midland	45,790
Liverpool and Manchester	49,320
Dublin and Kingstown	56,660

One of the most natural questions that can arise in considering these figures is that of how the large average mileage cost which they represent has been entailed.

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The answer to this query is not a simple one. The railway companies of the United Kingdom have not done much in the way of the publication of details of the cost of constructing their several lines. The promoters of many different railways have been ready enough to furnish estimates, on the authority of engineers of distinction, of the probable cost. Those estimates have, in the great majority of cases, been exceeded, some of them to a most serious extent, and hence the directors or promoters have not generally cared to put forward the actual facts, or, if they have been put forward, they have generally been obscured and overlain by irrelevant or supplementary details, from which the true cost can only be disinterred, if at all, with the greatest possible difficulty.

It would be easy to multiply examples of the facts just stated. Three notable cases, however, must suffice—(1) the London and Birmingham Railway, (2) the London and Brighton line, and (3) the Great Western Railway.

For the first of these three lines Mr. Robert Stephenson, the engineer, made the following estimate, which was submitted to the House of Commons in the usual way, and on the faith of which much of the capital was subscribed:—

Items.	Total Cost.	Average Cost per Mile.
Excavations and embankments	£179,000	£1,718
Tunnelling	250,286	2,275
Masonry	350,574	3,187
Rails, chairs, keys, and pins	212,940	1,936
Blocks and sleepers	102,960	933
Ballasting and laying rails	102,960	933
Fencing at £740 per mile	76,032	740
Land	250,000	2,273
Water stations and pumps	3,600	33
Rolling stock	61,000	555
Offices, &c.	16,000	145
Contingencies	294,648	2,679
Totals	£2,500,000	£22,727

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In this case, the actual cost of the line was £5,923,000 to the end of 1842, being 137 per cent. more than the estimate furnished by Stephenson.

The next case to which we shall call attention is that of the Brighton line, for which Mr. Charles Vignoles gave the following estimate in 1834:—

Statement showing the Several Items of the Estimate made by Mr. Vignoles for the Construction of a Railway from London to Brighton.

Items.	Total Cost.	Average Cost per Mile.
Earthwork	£417,527	£8,350
Masonry (bridges and culverts)	109,688	2,193
Viaducts	52,360	1,047
Tunnelling	113,500	2,270
Fencing	17,305	346
Laying railway	228,006	4,506
Land	48,750	975
Damages to property, &c.	25,000	500
Locomotive power and stock	37,000	704
Stations	20,000	400
Contingencies	108,922	2,178
Total	£1,198,148	£23,963

In the result, the Brighton line cost £2,586,000, or 118 per cent. more than the price estimated by Mr. Vignoles for his line of just over 50 miles.[1] Since it was constructed, however, the capital cost of the Brighton Company has been raised to over 23¼ millions sterling.

The third case—that of the Great Western Railway, from London to Bristol, a distance of 115 miles—is an estimate made by a highly distinguished engineer, Mr. I. Kingdom Brunel. The details are as under:—

[1] The London, Brighton, and South Coast Railway was not constructed by Mr. Vignoles, so that this estimate does not possess the same value that it would otherwise have done. It suffices, however, to show what a great engineer calculated that the line ought to cost.

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Mr. Brunel's Estimate for the Great Western Railway from London to Bristol.

Items.	Total Cost.	Average Cost per Mile.
Excavations and embankments .	£487,500	£4,239
Masonry	459,725	3,998
Tunnelling	279,195	2,427
Laying down railway . . .	630,400	5,478
Depôts	57,000	496
Locomotives and rolling stock .	57,000	496
Land and compensation[1] . . .	280,000	2,435
Contingencies	249,180	2,166
Totals . .	£2,500,000	£21,739

The actual cost incurred in this case to the end of 1842 was £6,540,000, being £4,040,000, or about 162 per cent. more than the original estimate upon which the line was authorised and begun.

The problem that appears to press for solution, in regard to these several estimates, is that of how these eminent engineers were led so far astray in their calculations.

There are several obvious causes for this result, and others that are not quite so manifest.

It is probable, in the first place, that no one ever anticipated that the expenditure to be incurred in procuring Parliamentary sanction for the several schemes referred to would be as great as it really was.

The Parliamentary expenses incurred in obtaining the Act for the Great Western Railway, as originally constructed, amounted to £87,197, or about £775 per mile. For the London and Birmingham line the Parliamentary expenses amounted to £72,868, or £662 per mile. In many other cases, the cost of fighting for the Acts under which the lines were constructed involved a correspondingly lavish scale of expenditure.

[1] Mr. Brunel mentions that this provides "a large overplus for contingencies upon the land."

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From this serious burden, the railways laid down in Continental countries, and in the United States, have, happily, been delivered—the sanction in the former case being granted direct by a department of the State, without any necessity for the promoters to enter the arena of Parliamentary contests, while in the latter case there is no such limit imposed upon the construction of railways.

There is, moreover, only too good reason to believe that the earlier railway engineers had no conception that the item of land would run up to such exorbitant sums as were actually paid, whether justifiably or not, by most of the companies promoting main trunk lines.

We have seen that Stephenson estimated £2273 as the cost per mile of the land required for the London and Birmingham line; that Brunel calculated the land required for the Great Western at £2435, including liberal compensation; and that Vignoles computed the average price to be paid for land on the Brighton line at £975 without, and £1475 with, compensation.

There is not much published information respecting the prices that have actually been paid for the land acquired by railway companies. There is, however, a general impression that, in the great majority of cases, the companies had to pay prices that were tacitly understood, if not actually so expressed, as intended to buy off the opposition of the landowners, as well as fairly compensate them for the compulsory acquisition of their property. Speaking of this subject, and especially of those who, at the outset, offered, or threatened to offer, a very stubborn resistance to the advent of railway enterprise, Mr. Dudley Baxter says:[1]—

"They acquired the habit of being bought off at high prices, and of exacting immense sums for imaginary damages. The first Eastern Counties line was said to have paid £12,000 per mile for land through an agricultural country, being about ten times its real value. This habit

[1] "On Railway Extension and its Results."

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of exaction has been perpetuated to our own day. As an everyday instance, I may mention that, only a few months ago, a gentleman of great wealth was selling to a railway company, which he had supported in Parliament, thirty acres of grass land, of which the admitted agricultural value was £100 an acre, and three acres of limestone, of which the proved value to a quarryman was £300 an acre. There was no residential damage, and the railway skirted the outside of the estate. The price of the whole in an auction room would have been about £4000. The proprietor's agents, supported by a troop of eminent valuers, demanded £25,000!"

What the actual expenditure incurred in the acquisition of land by British railways—including therein, of course, the sums paid as compensation—has been, no one is in a position to say, simply because there is positively no authentic information on the subject. It has, however, been put at £4000 a mile by authorities whose opinions are entitled to weight. This means that in respect of the land acquired for the present railway mileage of the United Kingdom—which, at the end of 1885, was approximately about 19,000 miles—the expenditure incurred would be about one-tenth of the total capital cost of British railways to the same date, or, in more exact figures, 76 millions sterling!

It is only when we compare these figures with those applying to other countries that we come to appreciate how materially they have affected the question of ultimate cost.

The Report of the Tenth Census of the United States (1880) sets out in detail the items that make up the cost of railway construction in that country to that date. Of these items, that for land is one of the lightest, being only 103¼ millions of dollars, or an average of £235 per mile, *including the buildings erected upon the land.*

If we select as a typical example of high expenditure under this head, that of the New York Central Railway,

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which passes through a densely populated district, and has been compelled to buy up large quantities of land in the neighbourhood of large towns, including the city of New York, we find that the average cost per mile for land purchase and compensation to the end of 1883 was 5618 dollars, or £1124, being little more than one-fourth the assumed average cost of land in the United Kingdom.

The difference in favour of Continental countries is quite as remarkable. In Germany, according to Dr. Lardner,[1] the average cost of land per acre was—

On the Berlin-Frankfort line	£69.2
„ Berlin-Stettin	46.0
„ Anhalt	63.0
„ Magdeburg-Leipsic	53.5
„ Saxon-Silesian lines	53.0

—which means that the average cost of land, as acquired for the earlier German railways, has been infinitely less than the corresponding expenditure in the United Kingdom.

This, however, is an exceptionally favourable showing, even for Continental Europe. In some other countries the land has absorbed a much larger proportion of the total capital outlay.

The expenses incurred in the construction of railways by the State in Belgium, up to the end of 1863, were as under, viz.:—

Items.	Expenditure.	Percentage of Total.
Price of land, compensation for crops, &c.	£1,063,129	20.0
Legal expenses	26,739	0.5
Permanent way construction . .	2,682,743	50.8
Materials—sleepers	283,010	5.3
„ rails and fittings . .	1,218,875	23.0
Fencing, planting, &c. . . .	7,704	0.1
Management to date of opening .	11,081	0.2
Totals . . .	£5,293,284	99.9

[1] "Railway Economy," p. 479.

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To the above sum must be added £1,110,332 for stations, and £1,678,234 for rolling stock, making up, with £209,618 for general expenses, a total sum of rather over 8 millions sterling.

The total mileage of railways belonging to the State at the above date was 466 miles, so that the cost of the land, including compensation, amounted to about £2280 per mile, or a little over one-half the assumed total for the United Kingdom.

It is interesting to compare European and American experience in this regard with that of our great Indian dependency. We therefore append a

Statement showing the Classification of Expenditure on Indian State Railways to 31st December 1882 (3426 miles).

Items.	Total Expenditure.	Expenditure per Mile.	Per Cent. of Total.
Preliminary expenses	£648,982	£189	2
Land	485,706	142	1
Construction of line	10,953,863	3,197	31
Ballast and permanent way	10,777,178	3,146	30
Stations and buildings	3,298,994	963	9
Steam-ferries	129,379	38	0.3
Collieries	34,003	10	0.1
Plant	1,022,012	298	3
Rolling stock	4,084,198	1,192	11
Establishment	2,940,522	858	8
Suspense account	1,580,757	461	4
Receipts on capital account deducted	44,663	13	0.1
Totals and average	£35,910,835	£10,507	99.5

The item of land purchase and compensation has not always, however, been unfavourable to the economical construction of English railways. In proof of this we may quote the case of one line, the Thirsk and Malton, 22½ miles in length, where all the landowners, with two or three exceptions, agreed to give their land at £60 an acre, including tenants' damages, so that the total cost of

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the line did not exceed £100,000, including stations, and every other item of expense except rolling stock.[1]

There are many items besides that of land and parliamentary expenses that differentiate English from Continental and American railways. It is obviously impossible to consider the whole of these in detail. All we can hope to attempt is to give a few suggestive facts as to their general scope and character.

While the division of the mileage into the total capital paid up is necessarily the only practicable method of comparing the cost of railways in different countries, without going into a very minute analysis of the several items of capital expenditure, there is probably no method of computation that more utterly fails to convey an exact idea of the facts that it is designed to elucidate.

In the construction of a railway there are many different items of expenditure demanding consideration. The most obvious of these is, as we have seen, the cost of the land, and the next is the laying of the permanent way. But these are only the initiatory steps in the enterprise. After the railway has been provided for to this extent, there are the stations to be built, in accordance with the requirements of the traffic, the sidings to be laid down, workshops erected for the repair, and, in the majority of cases, the building of carriages and wagons, and the rolling stock to be provided and maintained.

Many railway companies do not, however, stop here. They have swollen their capital account to its ultimate enormous porportions by the erection of steel and locomotive works, by the purchase of canals, by the construction and equipment of steamers, by the acquisition of land designed for future extensions, by the erection and furnishing of large hotels, and by the purchase or construction of docks and harbours.

Again, in some cases, although not in the United King-

[1] Evidence of Mr. T. E. Harrison before the Royal Commission on Railways in 1866, *Minutes*, p. 727.

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dom, railway boards have largely added to their capital expenditure by the purchase of coal lands.[1]

It is probably in the furnishing of terminal facilities that the capital cost of a line is mainly increased, at any rate in the United Kingdom.

This is a well-known fact to railway directors and managers; but, in order to bring it within the cognisance of the general public, it may be well to give a concrete example of what, under the modern dispensation of affairs, the leading companies are required to do in this direction.

The London and North-Western Railway had 1590 miles of open line in 1876, and 1811 miles in 1885. The total capital created or sanctioned by the company in the same interval rose from 69¼ to 104 millions sterling. On the face of it, therefore, it might appear as if an additional *thirty-five millions* of additional capital had been provided for the construction of 221 additional miles of railway, which would represent the colossal average of over £158,000 per mile. But a great deal of the increased capital was expended, not on new lines, but on providing additional terminal facilities and other accommodation for the mileage already constructed. On analysing the accounts for the ten years in question, we find that the following expenditure was incurred over that period:—

On London stations	£846,710
„ Liverpool do.	1,480,832
„ Manchester do.	1,047,343
„ Birmingham do.	748,954
„ additional engine-sheds, &c.	165,219
„ widening lines	3,548,381
Total	£13,519,694

The expenditure on widening lines may be readily appreciated as being a result of the greater number of

[1] This is a frequent thing in the United States, where the principal lines often possess and work large tracts of coal. The Chicago, Milwaukee, and St. Paul Company, for example, raise half a million tons of coal annually from their own mines.

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trains, and the additional traffic generally; but it will probably be remarked, as among things not generally known, that the expenditure incurred within the same interval on already existing stations in London, Liverpool, Manchester, and Birmingham was actually over four millions sterling, or fully half a million more than the outlay on widening the lines, &c., over the same period.

The same growth of capital expenditure on already existing lines appears in relation to the rolling stock. In 1876 and 1885, the relation of locomotive engines to miles open was the same, namely, 1.28 per mile; but, as between these two years, the relation of goods wagons to miles open rose from 23 to 25, and the difference would be paid for out of the increased capital expenditure.

It is amusing, not to say ludicrous, to compare the figures just quoted with those that illustrate the modest notions of the earlier engineers in regard to the same requirements.

Vignoles estimated that the twenty-six stations that he proposed to allow to the Brighton line, as projected by him, would cost £20,000, and he allowed only £150 each for the twenty stations that he contemplated erecting along the line. The main stations at either end, including the land required for their accommodation, he reckoned at £5000 each, and a goods station at Shoreham was put down at £4000, while six water stations were calculated at £500 each.

Brunel, again, was not much nearer the mark, since he only allowed £57,000 for the stations to be built on the Great Western line between London and Bristol; while Stephenson, in estimating £16,000 for the station buildings on the London and Birmingham line, calls up an irresistible smile in the light of present experience.

Nor were these distinguished men more capable of prevision and foresight in reference to the demands that traffic was likely to make on rolling stock. Brunel

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estimated £57,000 for the rolling stock of the Great Western line, Stephenson £61,000 for the London and Birmingham line, and Vignoles £37,000 for the Brighton line.

We cannot now separately distinguish the vehicles employed on the two former lines, as originally constructed; but on the Brighton line, instead of the 20 engines, 60 coaches, and 100 wagons estimated by Vignoles, there are at present—

410 engines,
2223 passenger carriages,
594 other vehicles attached to passenger trains,
7081 goods wagons, &c.,
445 vehicles not included in above,

making a total of 10,343, which, assuming an average of only £500 per vehicle, would represent a capital sum of £5,171,000, or more than four times the amount calculated by Vignoles as the total cost of the line and its equipment!

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CHAPTER XXIX.

ACCIDENTS ON RAILWAYS.

THE object of State interference with railway enterprise and administration, which we have already found to exist in all parts of the world, to a greater or less extent, may be regarded as threefold—

(1.) To impose necessary restrictions upon monopolist powers.

(2.) To preserve the public from exaction and injustice.

(3.) To secure the safety of life and limb.

The third consideration is the one that has invariably been regarded as the most weighty and important. Railway travelling is exposed to accident and mischance from a great variety of causes. To minimise these to the utmost possible extent is the principal aim of all well-regulated railway administrations, as well in their own interest as in that of the public, since, in every civilised country, the law gives redress against railway authorities for injuries to life and limb. This, therefore, is a question in regard to which the aim and the interest of the State and the railway world, as such, are identical; and both have applied their joint wisdom and experience in order to bring the risk of misadventure within the narrowest possible limits, with results upon which both, and especially the travelling public, are to be congratulated.

The subject of accidents on railways is such a wide and comprehensive one, that it may be approached from many different points of view. We can only hope to

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touch upon two or three. The first of these is necessarily that of the causes of accidents; the second, that of their effects. The provision that the statute law of different countries has made for meeting, or rather avoiding, such accidents will also demand consideration.

The railroads of the United States, being the largest system in the world, afford a very clear idea of the causes to which railway disasters are generally to be attributed.

The following tabular statement shows the number of accidents of all kinds that have occurred on American railways during the four years ending with 1885 :—

Years.	Collisions.	Derailments.	Other Accidents.	Totals.
1882	581	741	42	1,364
1883	630	926	84	1,640
1884	445	681	65	1,191
1885	464	681	72	1,217
Totals .	2,120	3,029	263	5,412

It is quite evident, from these returns, that the chief cause of railway accidents is defect of the permanent way, which, in the United States, accounts for 56 per cent. of all the accidents that happen.

The accidents to permanent way are divided into five separate categories. These have been tabulated as under:—

Years.	Breakage of Rails.	Rails Badly Placed.	Accidents on Bridges, &c.	Signals Broken or Damaged.	Broken or Damaged Crossings.	Totals.
1882	37	72	38	5	4	156
1883	84	88	35	13	7	227
1884	60	68	34	9	11	182
1885	102	65	32	13	11	223
Totals	283	293	139	40	33	788

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If we add the two first totals in this table together, we shall find that the number of accidents resulting from defective or broken rails was 576 out of a total of 5412, being 10 per cent. of the whole.

Collisions, however, are a still more prolific source of accidents, as the next table shows:—

Railway Accidents from Collisions in United States.

Years.	Trains Going in Same Direction.	Trains Meeting from Opposite Directions.	Collisions at Crossings.	Totals.
1882	388	160	33	581
1883	413	177	40	630
1884	280	138	27	445
1885	316	120	28	464
Totals .	1,397	595	128	2,120

It would thus appear that collisions account for about 40 per cent. of all railway accidents in the United States.

Not to enter into more minute details, which may be readily obtained by those interested in the subject, it appears that the chief general causes of railway accidents in the United States, other than those already specified, have been as under:—

Various Sources of Accidents on American Railways.

Years.	Accidents to Rolling Stock.	Negligence.	Obstructions on the Rails.	Unexplained Causes.	Diverse Causes.	Totals.
1882	102	101	144	238	42	627
1883	129	112	199	259	84	783
1884	67	94	152	186	65	564
1885	123	64	135	136	72	530
Totals	421	371	630	819	263	2504

It appears that the number and percentage of accidents

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due to each principal cause were, over the same period, as under:—

Summary of Causes of Railway Accidents in the United States, 1882-1885.

Causes.	Total Number of Accidents in Four Years.	Percentage of Total of all Accidents.
Permanent Way:—		
Breakage of rails	283	5.21
Rails badly placed	293	5.41
Accidents on bridges	139	2.57
Signals broken or damaged	40	0.74
Crossings broken or damaged	33	0.61
Total accidents to permanent way	788	14.54
Collisions:—		
Trains going in same direction	1,397	25.80
„ „ opposite directions	595	10.99
„ meeting at crossings	128	2.37
Totals	2,120	39.17
Rolling Stock, &c.:—		
Injury to rolling stock	421	7.77
Negligence	371	6.85
Obstructions on rails	630	11.64
Unexplained causes	819	15.00
Diverse minor causes	263	4.86
Totals	2,504	46.27
Grand totals	5,412	99.98

These figures sufficiently explain the origin of accidents over a very wide area of railway mileage. The most prolific *single* cause of accidents specifically given is that of collision between trains going in opposite directions; the second, that of obstructions on rails; and the third, that of injury to rolling stock. The breakage of rails has caused 283, and defects in rail-laying 293, accidents, so that there have been 576 accidents in all due to this source. These facts suggest whether Mr. Sandberg's strictures on the insufficient weight of American

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rails, relatively to the traffic which they require to carry, are not justified.[1]

The general custom followed, in recording the results of railway accidents, is to separate the numbers of passengers killed and injured from the *employés* of the railway companies who have similarly suffered. This distinction is a very necessary one, since the causes of the two descriptions of accidents are essentially different in nine cases out of ten. Railway *employés* follow an exceedingly dangerous occupation. They are exposed to many risks of accident from which the travelling public, *as such*, is exempt. Into the causes of accidents special to railway servants we cannot stay to inquire. Nor is it really necessary to bestow more than a passing allusion on the matter, since it has only recently been made the subject of a most painstaking and exhaustive inquiry by a Royal Commission, which has presented a valuable report to Parliament that is well deserving of careful study.[2]

In the following table, we have collated the official returns of the numbers killed and wounded on the railways of Continental Europe and other principal countries. This, we believe, is the first time that such a table has been drawn up, and it is full of instructive lessons. It shows that Denmark, Holland, and Norway are the safest countries to travel in; that Italy, Russia, Roumania, and Canada are the most dangerous; and that, notwithstanding the high rates of speed common in England, railway travelling is safer than in all except one or two of the countries dealt with.

[1] Mr. Sandberg urges, in a paper which he submitted to the Institution of Civil Engineers in 1886, that the weight of rails should be increased from 60 lbs. or thereabouts to 100 lbs. per yard, and some leading Belgian and English lines have endorsed his recommendations to the extent of adopting rails of 90 lbs. weight per yard.

[2] Report of the Royal Commission appointed to inquire into the Causes of Railway Accidents, 1877.

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Statement showing the Number of Passengers Carried on Different European Railways, the Numbers of Persons of all kinds Killed and Injured thereon, and the Averages Killed and Injured per Million Passengers carried in 1883.

Countries.	Number of Passengers Carried (1 = 1000).	Total Number of Persons		Average per Million Passengers Carried.	
		Killed.	Injured.	Killed.	Injured.
Germany	232,564	556	1,876	2.39	8.05
Austria-Hungary	47,212	227	478	4.83	10.17
Belgium	53,300	198	731	3.74	13.79
Denmark	7,037	5	23	0.71	3.28
France	204,758	531	1,087	2.59	5.30
Italy	34,271	171	838	5.03	24.65
Norway	2,471	5	1	2.50	0.50
Holland	17,151	24	36	1.41	2.12
Roumania	1,403	11	27	11.00	27.00
Russia	37,210	448	716	12.11	19.35
Switzerland	22,658	58	99	2.52	4.30
Totals and averages	621,848	2,234	5,912	3.90	10.33
United Kingdom	683,718	1,167	4,187	1.70	6.12
United States	312,686	473	1,910	1.51	6.10
Canada	9,982	227	796	22.77	79.60
India	58,876	354	611	6.00	10.36

It would hardly, perhaps, be altogether a fair assumption to conclude that these figures represent the relative degrees of danger incurred in working and travelling on the railways of the different countries tabulated, since it often happens that a single serious accident may maim and kill as many as twenty or thirty of minor account. But it may, nevertheless, be taken for granted that over the whole range of the railways of Continental Europe, the averages brought out will be fairly representative, viz. :—

3.90 killed per million passengers carried.
10.33 wounded „ „ „

There has been a much greater immunity from railway accidents within recent years than formerly—a result that is directly attributable to the greater vigilance and more effectual precautions exercised with a view to their

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prevention. This immunity is, of course, to be tested by the standard of the work performed, or the number of passengers carried, and not by that of the absolute numbers killed or wounded. Thus tested, we find that in the United Kingdom and France the average number of persons killed and injured per million passengers carried was as follows:—

Years.	Number Killed.		Number Injured.	
	France.	United Kingdom.	France.	United Kingdom.
1872	3.26	2.70	25.75	7.0
1882	2.59	1.70	5.30	6.12

And these figures are not exceptional by any means. They are fairly typical of the averages for each period, while the records of each year during the interval exhibit an almost continuous decrease of fatalities in reference to the business done.

Official returns issued for 1883 show that in that year the relation of accidents to passengers transported on the principal French lines was as under[1]:—

Countries.	Passengers Carried for every Passenger Killed.	Passengers Carried for each Passenger Injured.
Nord . . .	29,430,657	555,295
Est	16,263,619	756,477
Mediterranée . .	19,323,878	2,972,904

The total number of persons of all kinds killed and injured in the railway accidents that occurred in the United States during each of the four years ending with 1885 are shown in the next statement.

[1] Bulletin du Ministère de Travaux Publics, November 1885.

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Statement showing the Numbers Killed and Injured by Railway Accidents on American Railways, 1882–1885.

Years.	Total Number Killed.			Total Number Injured.			Total Killed.	Total Injured.
	Collisions.	Derailments.	Other Accidents.	Collisions.	Derailments.	Other Accidents.		
1882	177	200	3	578	975	35	380	1,588
1883	227	229	17	716	1,145	49	473	1,910
1884	172	192	25	624	1,062	74	389	1,760
1885	158	141	8	547	963	20	307	1,530
Totals	734	762	53	2,465	4,145	178	1,549	6,788

Here, again, we find, within a shorter period of time, a considerable improvement in the matter of safety.

In the accidents with which we have dealt up to the present time we have included railway servants as well as passengers. Manifestly the former, who follow what is at all times a highly dangerous employment, are much more liable to misadventure than the latter. There is a third class, which figures in the returns of the United Kingdom as "other persons," and which embraces trespassers, suicides, pedestrians passing over railways at level crossings, &c. In the returns for 1883, the following distinctions are made between the several classes in question:—

	Killed.		Injured.	
Passengers—				
Accidents to trains, rolling-stock, &c. . .	11		662	
„ due to other causes . . .	114		754	
		125		1416
Railway servants—				
Accidents to trains, rolling-stock, &c. . .	11		87	
„ due to other causes . . .	543		2373	
		554		2460
Other persons—				
Accidents at level crossings . . .	78		51	
„ to trespassers	293		165	
Suicides	61		...	
Other accidents	56		95	
		488		311
Totals . . .	1167		4187	

It is important to note that this statement assigns

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only eleven fatal accidents to passengers as a consequence of mishaps to trains, to rolling-stock, to permanent way, or to any other circumstances that the railway companies are supposed to have under control. Of the remainder of the accidents occurring to passengers, a great but undefined proportion is assigned to want of caution or misconduct on the part of passengers themselves. It will, no doubt, be the same in regard to other countries. If, then, we take the passenger fatalities in respect of which the railways admit direct responsibility, we find that in 1883 there were carried in the United Kingdom 68 millions of passengers for every one that was killed, and $1\frac{1}{8}$ million passengers for every one injured. If, however, we include other accidents to passengers, it transpires that $5\frac{1}{2}$ millions were carried for every passenger killed, and nearly half a million for every passenger injured.

If we take the railway returns of Belgium, we find that they fully bear out the same increase of safety, the following being the figures for nearly half a century :—

Total Number of Passengers Killed and Injured in Belgium, 1835–1883.

Years.	Total Number of Passengers Carried (1 = 1000).	Total Number of Passengers		Average per Million Passengers	
		Killed.	Injured.	Killed.	Injured.
1835 to 1840 . .	9,068	5	13	0.56	1.44
1841 to 1850 . .	35,632	7	47	0.19	1.31
1851 to 1860 . .	69,291	21	85	0.30	1.23
1861 to 1870 . .	162,771	16	117	0.10	0.72
1871 to 1880 . .	465,002	77	401	0.17	0.86
1881 . . .	57,240	13	117	0.23	2.05
1882 . . .	61,697	12	79	0.19	1.27
1883 . . .	63,665	10	70	0.16	1.09

The figures show that in the year 1883, 6,366,500 passengers were carried for every passenger killed, as compared with 6,039,000 in 1870–80, and that, for each passenger injured, there were 907,500 carried in 1883, and 1,160,000 in 1871–80.

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Liability for Accidents on Railways.

We now propose briefly to refer to the laws and regulations that affect and control the liability of railways and railway servants for accidents to passengers and *employés* in different countries.

GERMANY.

In Prussia, there appears to be no special legislation for the prevention of railway accidents. Each railway company has its own code of police regulations. There is, however, a general penal code in force for all the German States, which contains distinct provisions for the management of railways. Under this code, it is provided (sec. 316) that if, by any negligence, grievous bodily harm is caused to any person, the party so guilty shall be liable to imprisonment for one year. If the death of any person is caused by such negligence, the accused is liable to imprisonment for three years.

If any railway official employed in the conduct of the train, or in the control of the line or traffic, place a train in danger by negligence, he is liable to be punished by imprisonment for a term not exceeding one year. If any official is convicted of such an offence, he may be adjudged incapable of holding office in the railway service; and if the superintendent of a railway does not remove immediately such convicted official, he becomes liable to a fine of 100 thalers, or three months' imprisonment.

In Prussia, the railway companies were originally bound[1] to make good any damage sustained by goods or passengers carried by them. A company could only free itself from this liability by proving that the accident happened, either by the fault of the party injured, or by an unavoidable external accident. This law, however, was not general, and did not prove quite satisfactory; and

[1] Railway Laws of 1838, sec. 25.

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hence a new law was passed in 1871,[1] which provided (sec. 1) that "if a person has been killed or bodily injured, the party responsible for working the railway is liable for damage arising therefrom, provided that he does not prove that the accident happened through *force majeure*, or by the fault of the person killed or injured."

Any party interested in the life of a person killed on a railway, or who has a legal claim for support against the same, is entitled to claim damages, which, as a rule, have to be paid in the form of an annuity.

Inquiries into railway accidents are carried out by means of a State inquest, on the company giving notice of the accident. The results are published, if the accident involves a breach of the penal code.

There is, however, not a little vagueness and even confusion about the German regulations in reference to railway administration. The Government is supposed to retain a general control over all railways, State and private lines alike. Their police regulations, however, are directly under the control of each individual company,[2] the general police regulations notwithstanding.[3] The superior authority in railway affairs, under the State, is the Secretary of State for Trade, whose functions and powers appear closely to correspond to those of the President of the Board of Trade in the United Kingdom. The Secretary of State for the Home Department also exercises an occasional interference, as when he issues orders recommending strict attention to the laws for the prevention of accidents.[4] Lastly, there is a permanent Railway Commissioner, who is really an intermediary between the railways and the Government, and who is empowered to call meetings of the managing railway

[1] "Law concerning the liability to make good any damage caused by killing or bodily injury, in working a railway or a mine."

[2] Sec. 23 of Prussian Collection of Laws for 1838.

[3] *Bahnpolizei-Reglement für die Eisenbahnen im Norddeutschen Bunde*, 3d June 1870.

[4] Order dated 28th January 1871.

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boards, and to attend such meetings when otherwise convened.

AUSTRIA.

Under the law of the 5th of March 1869, it is provided, with reference to general liability for accidents, that—

(1.) Whenever bodily injury or the death of any person results from an accident on a railway on which the application of steam power is used, it is taken for granted that the accident has occurred through some fault of the company itself, or of some person connected with the working of it. The company is answerable for any accidents that may occur through the fault of persons employed by it.

(2.) The company will only be exempted from a payment of compensation when it can prove that the accident occurred through circumstances over which it had no control, or through the action of some third person, or through the fault of the person who may have been injured. Any limitation of or refusal to comply with this obligation of paying compensation on the part of the company is unlawful.

(3.) Complaints with regard to the payment of compensation, which arise through this law concerning accidents, and which follow in consequence of its operation, can be heard, according to the choice of the plaintiff, before the Tribunal of Commerce of the district in which the company in fault is situated or in which the accident occurred. Summary proceedings must be taken against such companies; and several plaintiffs, whose claims for compensation arise from the same cause, can enforce an action at the same time.

With a view to securing safety for life and limb, many different enactments are made under an earlier code—that of the 16th November 1851—which provides, *inter alia*, that after the train has been made up, there must be a revision of it; that an interval of fifteen minutes must elapse before a passenger train can follow a goods train;

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that lost time should never be made up by an increase of speed; that passenger trains shall not exceed a speed of seven German miles per hour, &c. Penalties are attached to the non-observance of all these requirements.

France.

According to the law of France, railway companies are responsible for accidents both to passengers and to their own workmen, whether caused by defects of construction and working, or by negligence on the part of their *employés*. The Code Napoléon imposes liability upon every one who causes hurt to another, whether by his negligence, by his imprudence, or otherwise. Whoever so causes the death of another is, under the penal law, liable to imprisonment for a period varying from three months to two years, and to a fine of from 50 to 600 francs.

The principal laws directly affecting the liability of railway companies are those of the 15th July 1845 and of the 15th November 1846. These two documents have been the basis, from that time to the present, of a very numerous body of circulars, rules, decisions, and enactments relative to railway liability.

The United States.

It has already been pointed out that in the United States the general Government has very little control over the railways. There is, therefore, no special legislation affecting railway companies as a whole, but several of the states have adopted regulations designed to secure safety to life and limb, to which the companies are required to conform. Level crossings are a prolific source of accidents. The steam-whistle is generally employed at such points and at stations. There is no general law regarding the testing of bridges, &c., before a line is opened; but in several states commissioners are appointed for the purpose of certifying to the condition and efficiency of such structures. In the absence, however, of any general enact-

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ment, the decisions that have been given in innumerable cases brought against the companies form the only guide to the extent and character of railway liability. From these decisions it would appear that a railway company is liable in damages for an injury resulting to any person lawfully using its road from its neglect to introduce any improvements in its machinery and apparatus known to have been tested and found materially to contribute to safety, and the adoption of which is within its power, so as to be reasonably practicable.

To the liability of a railway company as passenger carriers two things are requisite—(1) that the company shall be guilty of some negligence or omission which mediately or immediately produced or enhanced the injury; and (2) that the passenger should not have been guilty of any want of ordinary care and prudence which directly contributed to the injury, since no one can recover for an injury of which his own negligence was in whole or in part the immediate cause.

Within the last few years, and chiefly, it may be assumed, on account of the increased peril to life by railway travelling, it has been provided by statute, in many of the American states, that redress shall be given against the party causing personal injury from which death ensues. These Acts, although intended chiefly to stimulate watchfulness in passenger carriers, especially by railway, are made general, and in some of the states penalties are imposed where neglect can be proved.

In Pennsylvania the rule is, that in case of death the jury are to estimate damages "by the probable accumulations of a man of such age, health, habits, and pursuits as deceased, during what would probably have been his lifetime."

By the law of Massachusetts, passenger carriers causing the death of any passenger through their own negligence or carelessness, or that of their servants or agents, within the commonwealth, are subjected to a fine not

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exceeding 5000 dollars (£1000), to be recovered by indictment preferred by the executor or administrator of the deceased person, "for the benefit of his widow and heirs."

Under the New York State law, a wife cannot maintain an action for the death of her husband, nor a father for the loss of service of his child by death; and if there be no wife or next-of-kin no action will lie.

By the Statute of Illinois, the right of action in such cases is given to the personal representative, and the damages recovered are for the exclusive benefit of the widow and next-of-kin.

The Connecticut State law of 1853 provides that, when the life of a passenger is lost by reason of the negligence of a railway company, the company shall be liable to pay damages ranging from one to 5000 dollars, to the executor or administrator, to be recovered by action for the benefit of husband, widow, or other heirs of deceased.

ITALY.

By virtue of the powers given to the Government by the Public Works Law of 1859, regulations defining the extent of the liability of railway companies for accidents on their lines were issued by royal decrees in 1862 and 1863. They were maintained in force by the Public Works Law of 1865, although the law of 1859, pursuant to which they had been made, was repealed.

The first series, dated October 30, 1862, relates to the police, safety, and regular working of railways. It contains rules for the security of lines and stations, the selection, examination, use, and repair of rolling stock, the composition and circulation of trains, the settlement of time-tables and tariffs, the management of both goods and passenger traffic, the exercise of supervision by the Government, besides general rules concerning the duties of directors and their subordinates.

All persons employed on railways are declared responsible for the strict observance of these regulations, as well

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as of all laws relating to railways, and, moreover, for any injury resulting from fault, carelessness, or inactivity on their part.

Railway companies are likewise declared responsible to the Government for all defects or irregularities in the working of their lines.

Immediate information is required to be given to the Government agents of any occurrence which may have hazarded the safety or the regularity of the traffic, even when no actual inconvenience has been caused thereby. The Minister of Public Works must also be made acquainted with all the particulars of accidents.

The Government exercises control over the railways by means of commissaries under the authority of the Department of Public Works. Railway directors are bound to conform to all the regulations made by that department for the regular and safe working of their lines.

United Kingdom.

In the case of the United Kingdom, the general law is put in motion in order to obtain redress from a railway company in case of accident to passengers. As regards their own *employés*, railway directors generally make arrangements that avoid litigation. The criminal law is enforced against any *employé* who causes the death of another through negligence or indiscretion; and while the verdict is invariably one of manslaughter, the penalty imposed is usually proportioned to the extent of the negligence or culpability.

Many of the accidents occurring on English railways are found to be due to combined causes, and usually more to a lax enforcement of good regulations, or to a neglect in using appliances for safety which are in existence, than to the absence of regulations or appliances for safety. When accidents occur from an absence of regulations or a want of the necessary appliances for safety, it frequently appears that such absence is due to the cir-

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cumstances of the traffic having been altered, and to elements of danger having been gradually developed without anything having occurred to bring the altered circumstances to the notice of the manager. The Royal Commission of 1867 pointed out that "Government interference would not necessarily meet this case. It was," they held, "the tendency of Government inspection to seek to multiply accessories to safety; these accessories are more or less valuable, according to the condition of the traffic on a line, and the manner in which it is worked. So long, therefore, as those who control the traffic are free to accept or to reject the Government recommendations, it is very desirable that they should be made. But the more such appliances are multiplied the greater are the chances of danger from their neglect or their failure to act, though the chances of danger are diminished or increased according to the class and character of the men who use them. The selection of the men must always rest with the manager, and he should, therefore, remain responsible for the selection of the appliances for safety which he places in their hands."

Mr. Cardwell's Committee in 1853 examined very closely into the question. The Committee arrived at the conclusion that any interference with the details of management was undesirable, but recommended that there should be placed upon those in whom the management of railways is vested, a greater degree of responsibility than the law then admitted, and proposed that each railway company should have an engineer, a locomotive superintendent, and a traffic manager, who should each be responsible for the proper working of his department. The Committee also proposed to call in the interposition of the Board of Trade to watch over the public safety. They had been appointed at a time when accidents recurred so frequently, and were attended with consequences so serious, that if no change had taken place in that respect severe legislation would have been required. But the marked diminution in the

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number of accidents which subsequently occurred induced Parliament to postpone any legislation at that time.

In the year 1865, out of 252,000,000 travellers, 23 only met with death by causes beyond their own control. This led the Duke of Devonshire's Commission to remark that "no other mode of locomotion ever used by man can show a more satisfactory result, and we are therefore not prepared to suggest any alteration of the present law in this respect." The Commission added that "Parliament has relied for the safe working of railways upon the efficiency of the common law and Lord Campbell's Act, which gave persons injured and near relatives of persons killed a right to compensation. We consider that this course has been more conducive to the protection of the public than if the Board of Trade had been empowered to interfere in the detailed arrangements for working the traffic." The Commission further recommended that "to the power which the Board of Trade at present possesses of appointing officers to inspect railways and rolling stock, should be added a power for the inspecting officer to require the attendance of the officers and servants of the company as witnesses, and the production of books and documents bearing on inquiries directed by the Board of Trade, and that the reports of the inspecting officers on accidents should be made public." These recommendations have since been carried out, and as a result of this fact, and of the constant care exercised both by railway directors and the Board of Trade, accidents to passengers, as we have already seen, have greatly diminished.

The amount of compensation paid by railway companies, including the heavy fines occasionally levied, when spread over the whole number of travellers, amounts to a very small sum per passenger per mile. In 1865 the total compensation for personal injury was less than 1 per cent. on the gross receipts, in 1876 it was only 0.5 per cent. of the gross receipts, and in 1883 it amounted to only 0.3 per cent. of the gross receipts.

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CHAPTER XXX.

RAILWAYS AS STATE PROPERTY.

AMONG the great problems which belong to the domain of domestic legislation, one that is likely to force itself into the front rank before many years have elapsed is that of the acquisition by the State of the railway sytems of countries that have not heretofore adopted or approved of Government interference. It is not a little remarkable that among European nations England is as singular in reference to the relations of the State and her railway system as she is in her economic creed. Every other country in Europe has a larger or smaller proportion of State-owned and State-controlled railways. In some countries, as in Denmark, the State is practically the sole possessor of these ways of communication. In others, the State owns but a very small share of the total mileage laid down. But in almost all cases alike provision has been made for the ultimate acquisition of the railways as a whole, by the nation and for the nation. In England no similar state of affairs exists. The railways of Great Britain are entirely owned by private companies, who, within the limits of their several Acts, and the restrictions imposed by Parliament in a number of general Acts, wield practically uncontrolled dominion over a system that is of greater ultimate importance, in its influence on the destinies of the country, than almost any other that can be named.

The controversy as to the comparative merits of State and private ownership in railways is by no means a new one. It has been taken up in England over and over

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again. It has been the subject of numerous debates in Parliament. It has occupied the serious and protracted attention of Select Committees and Royal Commissions. It has now been regarded with favour, and then with disfavour, according as the exigencies of the trade and commerce of the country appeared to approve or otherwise. But there probably never was a time when the question demanded such serious and grave consideration, when the urgent and exigent requirements of the country so signally favoured its settlement, when it appeared more easy to choose between the two alternatives presented for adoption, as now.

The railway system of Great Britain has been on its trial for the last half-century. For nearly the whole of that period it has been exposed to constant criticism and complaint. It has many apologists in Parliament, in society, in the commercial world, and in the press. But, as regards its suitability to the needs of the country, there is still much difference of opinion.

Let not these apparently captious comments be misunderstood. It may be that the railways of England have been as well, as justly, as fairly, and as economically administered as was possible under all the circumstances. It may be that the facilities provided for the convenience and development of traffic have been all that could be desired. It may be that the range of rates and fares is not, on the whole, so far behind that of other countries, and that traders, all things considered, have not so much reason to complain. The *crux* of the matter is not any, nor all, of these considerations. Railways, it is argued, are a national necessity, and, as such, ought to be a national possession. If the postal and telegraph systems were properly taken under Government control, there seems much more reason why the railway sytsem should be, since railways are not only used by all, but exercise a power and influence on our social and on our business relations that no other single element can claim to do. But above

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and beyond all this, there is the future to be considered. If it be true that civilisation is coincident with extent of commerce, and that not only the prosperity of a country within its own borders, but its place in the family of nations, is determined by the variety and magnitude of its industrial interests, then undoubtedly it may be argued that railways are the real arbiters of national destinies.

Every manufacturer and merchant already knows, to his cost, that there is such a thing as foreign competition. But what shall that competition have become when the railways of Germany, Belgium, and other European countries have become free, and when they are no longer called upon to provide for capital expenditure? When that day does arrive, as arrive it surely must, the railways of the Continent will be able to maintain tariffs that simply cover the cost of working. The profits over and above that will be applied to reductions of rates and fares. England, on the contrary, with her present capital of over 820 millions embarked in railways, must draw 41 millions per annum from the public in order to pay 5 per cent. on this capital expenditure, and a correspondingly smaller sum for any lower rate of interest. But suppose that the sum required for this purpose were only 20 millions a year, being equal to 2½ per cent. on the present capital expenditure—which may by that time have fully doubled—the commerce of the country would manifestly be handicapped to that extent, in competition with rival nations, where the railways entailed no such annual charge. Cassandra may fitly utter words of warning in view of these facts. If we find it difficult to hold our own as things are now, where shall we be when our foreign competitors come into the enjoyment of this great and influential heritage? This is a problem that is likely to press for solution.

Sir. R. Hill gave the following, among other reasons, why railways should belong to Government[1]:—

(1.) That the formation of competing lines, while not

[1] Report of the Royal Commission on Railways, 1867.

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producing, but rather preventing, permanent reduction of rates, has grievously injured the interests of existing companies, and tended to check the useful extension of lines and other improvements.

(2.) That railways, being shown by experience to be essentially monopolies, cannot be advantageously left to independent companies, but should be in the hands of those who are charged with the interests of the country at large, viz., the Government.

(3.) That, nevertheless, Government should not itself attempt the immediate management of the lines, but should lease them to companies or individuals, though retaining the power to enforce the observance of all regulations necessary for public safety and convenience.

(4.) That the State should, therefore, gradually purchase the whole railway system, with the exception, perhaps, of a few lines, on terms to be agreed upon with the several companies.

(5.) That such purchase does not necessarily involve any outlay on the part of Government, seeing that the transfer may be made on such arrangements as are generally adopted when a line is transferred from one company to another, so that no increase of the National Debt is implied.

(6.) That, while the rent demanded for a line must be sufficient to cover the payments by Government in dividends, interest, &c., to the previous owners, preference amongst competent applicants should be given to the one who offers to adopt the lowest tariff of charges.

(7). That Government purchase of railways may be expected to secure the following advantages, viz. :—

(*a.*) A pecuniary gain to the State.

(*b.*) A gain to shareholders and others in steadiness and security of income.

(*c.*) Security against Parliamentary contests, now so costly.

(*d.*) A reduction (eventually large) in fares, freights, &c.

(*e.*) Greater efficiency of management.

(*f.*) Increased postal facilities.

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Every one of these claims has been traversed by the opponents of State control. This is not a matter for wonder, since every question presents more than one aspect. We shall, therefore, submit the principal arguments used on the other side.

With regard to the State purchase of railways, the Duke of Devonshire's Commission found—

"That the improvements required to lines and stations must be directly paid for by the State, or the State would have to allow for them at the end of a lease.

"That the Crown would be obliged to employ properly qualified and highly paid engineers and others to take care that the national property was kept in proper order by its lessees, and that all the conditions of the leases were properly complied with.

"That if the Government, as lessors, interfered to any great extent with their lessees, there would be a divided and a still less efficient administration, of which any profit would go to the lessees, while any loss would in the end fall on the public revenue.

"That the original terms of the lease, and the more or less stringent enforcement of its conditions, might be tempered by political considerations.

"That the exercise of a discretionary power over railway companies would be open to serious objections, and would inevitably lead to abuses.

"That it would be extremely difficult to frame such general laws as would be applicable to the many particular cases which arise from the great variety and diversity of productive and commercial undertakings in this country.

"That, as there is no intention of cheapening the means of conveyance by railway at the expense of the national exchequer, all general laws should be such as would not entail any loss in working.

"That, as Parliament has reserved to itself the right to pass any general law for the regulation of railways, it would be just as easy to legislate on this basis for the existing system.

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"That if the Crown purchased the railways, it would be compelled to acquire all their auxiliary undertakings, such as docks, warehouses, steamers, canals, harbours, and workshops; and that this new policy would involve a consideration of the position of the rest of the canals, docks, &c., which are not so connected with railways, but which would then be compelled to carry on to some extent a competition with the State and its resources."

It would take up far too much space if we were to attempt to consider each of these propositions at such length as would be absolutely necessary for its proper elucidation. But we may attempt—as we believe it has never been attempted before—to show how State and private railways compare on the Continent of Europe, where both have coexisted for many years. In this way, we shall bring the arguments on both sides to the only unanswerable and conclusive test—that of solid facts.

That economy of administration would be secured by State control appears to be established by the following figures :—

Statement showing the Percentages of Total Working Expenses Expended on Administration on the State and Private Lines, respectively, of Different European Countries.

Countries.	State Lines.	Companies' Lines.
	per cent.	per cent.
Germany	9.40	13.10
Austria-Hungary	6.50	8.47
Belgium	5.05	10.13
Denmark	6.89	5.77[1]
France	16.16	9.58
Italy	6.49	8.76
Norway	7.30	7.00
Holland	5.30	10.35
Roumania	4.40	10.80
Russia	9.27	13.70
Finland	9.78	...
Switzerland	...	8.57

[1] This also applies to State railways, but under management of private companies.

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The case of France appears to call for special comment, since it appears that the companies' lines are much more economically managed than those of the State. The fact is that in France the State owns only the feeders to the main trunk lines, which are the property of a number of large corporations. These branch lines, scattered over a great part of the kingdom, require a great deal more administration than the six or seven great main trunk lines in the hands of the Nord, the Est, the Paris and Orleans, and other companies, which unitedly control more than one-half the total mileage of the country. France, therefore, is exceptional. But in the case of countries where the conditions of the comparison are more parallel, the State lines will be seen to be invariably the more economically managed as regards administration. Belgium supplies one of the most notable examples of this economy, the State-controlled lines being administered for less than one-half the relative cost of the lines belonging to private companies.

The other elements that enter into the total cost of railway working can hardly be subjected to the same strict analysis as that of direction. The conditions under which the traffic of different railways is carried on are apt to vary so much that it would probably be unwise to attach too much importance to the other items that compose the aggregate of working expenditure; but with reference to two—maintenance of way and traffic expenses—the State and private railways of Continental Europe compare as under:—

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Statement showing the Percentage of Total Working Expenditure applied to Maintenance of Way and Traffic Expenses, respectively, on the State and Private Railways of Different European Countries.

Countries.	Maintenance of Way.		Traffic Expenses.	
	State Lines.	Private Lines.	State Lines.	Private Lines.
	per cent.	per cent.	per cent.	per cent.
Germany . . .	35.90	28.20	31.10	35.30
Austria-Hungary . .	38.12	30.21	29.03	32.54
Belgium	24.04	24.86	25.96	32.79
France	24.15	20.83	27.57	34.77
Italy	22.01	26.68	35.98	31.84
Holland[1] . . .	29.70	25.59	36.90	35.53
Roumania . . .	38.10	29.20	22.70	28.40
Russia	40.40	31.03	11.83	21.34

Two facts stand out with special prominence in this table—the first, that the cost of maintenance of way is generally higher on the State lines; the second, that traffic expenses take a higher range on the lines of private companies.

It might easily be contended, and even proved beyond all doubt, that the first characteristic is a result of the better condition in which the State keeps the permanent way; and, so far as this is the case, the public convenience, safety, and general advantage are promoted.

The higher range of traffic expenses on companies' lines undoubtedly argues greater laxity of management, since, as we have already shown, this is one of the most elastic of items, and may be either very high or very low, according as economy or extravagance is the prevailing system.[2]

So far, then, as we have already gone, the experience of Continental Europe points unmistakably to the exer-

[1] In Holland, the railways belonging to the State are worked by a private company.

[2] *Vide* Chapter XV., *ante*.

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cise of greater economy in State management. We might easily proceed to show that this essential difference is equally characteristic of other and more technical features of railway administration. But the main facts bearing upon this point will be found set out in other parts of this work.

Before leaving this part of the subject, however, the results of the State control of railways in Belgium may be referred to:—

"The experience obtained in Belgium of the working by the State of at least a portion of the railways existing in that country, is entirely in favour of that system. . . .

"Notwithstanding the superior financial result, the lines worked by the State are those kept in the best order, and the working of which gives the greatest satisfaction to the commercial world and the public in general, as regards regularity of conveyance, cheapness of transit, and the comfort of travellers.

"The State, not being solely guided by the prospect of financial gain, but having constantly in view the interest of the public which it represents, is in a better position than private companies to introduce all desirable improvements, not only as regards the efficient performance of the service, but also as respects the cost of conveyance, without, however, altogether disregarding the increase of revenue which its operations may bring into the public treasury.

"The State railways thus find themselves placed in constant comparison with the railways worked by private companies, on the one hand stimulating them to general improvements, and on the other hand acting as a sort of check against any attempt to realise extravagant profits at the cost of the public."[1]

The Royal Commission on Railways (1867) reported

[1] Report on the Administration of the Railways of Belgium made to the Royal Commission on Railways, 1867, *Report*, vol. i. p. 7.

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that none of the witnesses examined by them had recommended direct management by Government officers, but, in the opinion of some, great advantages would be derived from the adoption of a plan of leasing the railways in groups.

The Commissioners, however, were unable to perceive that the expectation referred to rested upon any solid foundation.

"The capital," they say, "required by lessees for working a group of lines would no doubt be comparatively small, but yet it is manifest that Government could not safely enter into engagements with any lessees who were not prepared to give ample security for the payment of the stipulated rent. Practically, therefore, the lessees would be either joint stock companies or wealthy capitalists. If the former, there is no ground for assuming that the directors of these companies would possess qualifications not to be found in those who now manage the affairs of railway companies; if the latter, they would not, in most cases, individually possess the knowledge or experience required for the direct management of the concern. In either case, therefore, it is probable that the actual conduct of the business would fall into the hands of the present staff, as the servants of joint stock companies or private capitalists; but if other persons undertook the duty, there is no guarantee that they would possess more capacity than the present officers, while it is clear that they would possess less experience.

"Again, the transaction must necessarily be attended with risk to the lessees. They would be in this position: if the net earnings should exceed the rent, even by a small amount, such small excess might afford a good dividend on the comparatively small capital invested by them; but, on the other hand, if the rent should exceed the net earnings by only a small amount, they would be altogether deprived of any dividend. It is, therefore, naturally to be anticipated that any lessees, in calculating the rent they would be prepared to offer, would make large allowances for the specu-

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lative character of the undertaking, and consequently it is far from manifest that the State could rely on obtaining a rent adequate to reimburse it for the outlay in purchase. It further appears to us improbable that lessees would be found willing to fetter themselves by conditions imposing on them the reduction of fares and rates, or otherwise depriving them of the liberty of managing their affairs as they might think most conducive to their interests; and we are unable to perceive that their position would be more favourable than that of the existing boards for trying the effect of experiments, which, though they might ultimately be advantageous, would, on the assumption we have made, necessarily be attended with immediate loss."

The condemnation by the Commissioners of the theory that the Government would be able to borrow money on easier terms than private companies was equally sweeping and decisive. This expectation, they said, "is based upon the assumption that, as the Government can borrow money on more favourable terms than any other parties, this difference in the rate of interest would either be available as profit to the State, or would afford an opportunity for the reduction of rates.

"It is possible that a profit from this source might be obtained, if Government could buy the railways at twenty-five years' purchase of their average net profits; but at present, unless the profits amounted to 10 per cent. on the capital expended, an additional amount would have to be paid, to be fixed by arbitration, and it is probable that any arbitrator between the Government and private companies on such a question would make a very large allowance for future increase of profits.

"There being also above 2300 miles (including some of the most important lines in the country) not subject to the Act of 1844, the purchase of these lines, which would be absolutely necessary to carry out the scheme, could only take place with the consent of the proprietors, and this could only be obtained by the offer of liberal terms.

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"It is probable, therefore, that in practice much of the assumed profit would disappear in the extra price, above the assumed twenty-five years' purchase, which would have to be paid.

"In addition to the diminution of assumed profit arising from this cause, it must not be forgotten that, as the Government would have to enter the market to borrow £400,000,000 or £500,000,000[1] to carry out the operation, the terms upon which this could be raised would in all probability be materially affected.

"The depressing effect upon public securities would be equally felt, whether the Government conducted the whole operation at once, or whether it came into the market year after year to repeat an operation of about £25,000,000 a year; and it is not easy to foresee what the price of consols would be under the proposed addition of £500,000,000 to the national debt.

"It is, therefore, probable that the Government would have to exchange the income of the railway companies for an equivalent income in consols, to avoid being called upon to make cash payments for the purchase-money, which would have to be paid out of money borrowed in consols; so that it could hardly be expected that, under the provisions of the present law, much profit could result to the State from the transaction as a financial operation."

There can be no doubt that the views here set forth by the Royal Commission of 1867 are to a large extent entitled to weight, and would be found, in the main, to be justified by events. At the same time, the Government have made no overtures that would be likely to show the effect of such action as that indicated.

It must not be forgotten, that railway property in this country has within recent years been a *decreasingly* profitable investment. The average rate of interest paid by the railways of the United Kingdom as a whole has been

[1] It would now be very much more.

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diminishing for some years. There are nearly 100 millions of railway capital out of a total of rather over 800 millions, on which no dividend has been paid for a number of years. It is, no doubt, expected that this unremunerative property will improve as time goes on; but since a great deal of it is located in agricultural districts, where there is little scope for traffic development, the prospects of such an improvement are by no means very immediate.

That the State can borrow money on much easier terms than private concerns is a truism that need not be dwelt upon. The average rate of interest paid on the loan capital of English railways at the present time is 4.2 per cent. It is quite possible that the State could borrow all the money it requires at 3.5 per cent. But even if it were able to save only a half per cent., this would represent, on the present railway capital of this country, an economy of *four millions sterling* a year.

In all the legislation that has taken place in reference to British railways since 1844, the possible ultimate acquisition of the system by the State has been steadily kept in view.

In that year an Act was passed (7 & 8 Vic., c. 85) which empowered the Treasury to purchase the railways of the country, as sanctioned in that or any future session, upon certain specified terms.

It was specially enacted that this option of purchase should not extend to any railway the construction of which was authorised before the session of 1844. But any railway company, subject to its provisions, may require that, if the Government purchase a branch of their line sanctioned subsequently to 1843, they shall also purchase the whole of the company's lines.

At the end of 1843, the length of railway authorised by Parliament amounted to 2390 miles, of which 2036 had been opened for traffic. The authorised capital for these lines amounted to about 83 millions sterling, of which about 60 millions had been raised, so that not more than

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one-twelfth of all the railway capital subscribed was exempt from this option of purchase on the part of the State.

As it happened, however, these 2036 miles of line were by far the most important in the country, embracing, as was pointed out by the Royal Commission on Railways (1867), all the main lines of communication except the Great Northern.

This circumstance led the Commissioners to remark that "if the State elected to purchase the railways, it would never, except with the concurrence of the proprietors of the lines, become the possessor of the whole of the principal main lines of railway, such as the Great Eastern, London and North-Western, Great Western, and London and South-Western, but in these cases would become possessor only of numerous lines which (like the Trent Valley) are integral parts of the several systems."

This objection is not now of such validity—if it ever had any—as it was in 1867. The following figures show the mileage of the principal railways open in 1844 and at the present time:—

Railways.	Miles Open in 1844.	Miles Open in 1885
Great Western	176	2,301
Lancashire and Yorkshire .	81	496
London and North-Western .	405	1,811
London and South-Western .	94	722
Midland	289	1,388
North-Eastern	390	1,534
Great Eastern	115	1,038
Totals . . .	1,550	9,290

These comparative figures clearly show that in 1844 only 1550 miles, out of a total ultimate system of 9290 miles, had been opened in the cases quoted, being less than 16 per cent. If, therefore, the option were still open, it would be competent for the State to purchase 7640 miles

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out of the total of 9290. It may be that the 1550 miles constructed prior to 1844 are the cream of the several systems, although there is no evidence to prove this. But if the State had elected to exercise its prerogative, under the Act of 1844, and decided to acquire the 7640 miles that have since been constructed, the several systems would obviously be so maimed and emasculated that the companies would be bound to come to some kind of reasonable terms with regard to the acquisition of the remainder. The Act of 1844, however, provided that, if the State elected to purchase the railways authorised subsequent to that year, such purchase must take effect within twenty-one years. That period having now long since elapsed, the provision is no longer operative.

At the end of 1885, the total capital embarked in the railways of the United Kingdom amounted to about 816 millions sterling. In order to pay a dividend of 10 per cent. per annum on this amount, an annual net income of 81½ millions would be required; and twenty-five years' purchase of this sum would be not less than 2025 millions sterling, which is 1209 millions, or nearly 150 per cent., more than the sum actually embarked in British railways up to the present time. And yet, if the terms proposed in 1844 were to be adopted now, no less a sum than this would suffice to procure for the nation the control of its railway lines. It is true that the Act of 1844 provided that if the average dividends on the capital expended did not reach this average, such additional sum over and above twenty-five years' purchase of net profits as would have to be paid should be settled by arbitration. But, as the Devonshire Commission has pointed out, a large allowance for future increase of profits would be likely to be demanded and allowed under this arrangement.

On the other hand, it is manifest that if the basis of the transfer of the railways to the State were to be twenty-five years' purchase of the actual net profits—which amounted to about 33 millions in 1885—the sum

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to be paid on behalf of the nation would only be 825 millions, or within 9 millions of the actual expenditure up to the end of that year.

Between these two extremes there is a wide margin for negotiation. Should the purchase of the railways ever be determined on by Parliament, it would seem fair to allow a certain amount for future increase of profits, seeing that railways have generally been attended with a large and rapid development of business. On the other hand, however, it is important to bear in mind, as qualifying circumstances—

(1.) That since 1860 the average dividend paid on the capital embarked in British railways has never exceeded 4.74 per cent. in any one year, and has declined steadily during the four years ending with 1855.

(2.) That these figures prove that an increased traffic and an increased gross revenue do not of necessity mean increase of profits.

(3.) That there has been a great deal of extravagant and perhaps unnecessary expenditure on behalf of British railways, which the State should hardly be expected wholly to make good.

(4.) That it is now within the power of the State to build competitive and much cheaper lines, which would tend to depreciate the value of existing railways.

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CHAPTER XXXI.

THE COST AND THE CONDITIONS OF WORKING RAILWAY TRAFFIC IN DIFFERENT COUNTRIES.[1]

It goes without saying that the subject of railway transport is one of great importance—important alike to the general public, whose social and industrial welfare is so closely bound up with adequate and inexpensive transportation facilities; to the investing public, whose main concern is to see railways established as profitable commercial undertakings; to the economist and statistician, who find in the widely-ramified phases of railway development one of the most inviting and fertile themes for their philosophic speculation and treatment; and to the many industrial interests that are largely maintained by, and consequently dependent upon, the enormous business which is necessary to meet the everyday requirements of railway enterprise.

The working of railway traffic is a subject that presents such a great variety of aspects that it is manifestly impossible to deal with it in a satisfactory, far less an exhaustive, manner in the short space available here. Nevertheless, it may be found practicable to put forward

[1] This chapter formed the subject of a paper read by the author at the opening meeting of the Statistical Society of London on the 16th November 1886. The principal sources of the data made use of in this paper are:—

1. The railway returns for the United Kingdom, issued by the Board of Trade.
2. The statistical abstracts of the principal and other foreign countries, also issued by the Board of Trade.
3. Poor's manuals of the railroads of the United States.
4. Statistique des chemins de fer de l'Europe pour l'année 1882, avec les resultants de cet exercise pour l'année 1883.
5. The report on railway transportation in the United States, issued from the Census Office, Washington.

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facts and suggestions calculated to draw attention to some characteristics that are more or less peculiar to each country; and if such a result should happily contribute, in however small a degree, to aid in the solution of the intricate railway problems that are likely, before many months have elapsed, to claim the most earnest consideration of Parliament, the very considerable labour involved in the preparation of the *data* that follow will not have been undertaken in vain.

At the threshold of our inquiry we have to face the remarkable and largely inexplicable differences that occur in regard to the first cost of construction and equipment. Table A in the Appendix will make these differences manifest. It embraces the railway mileage constructed in the principal countries of the world in 1883, and shows that the average expenditure incurred per mile of line open varied from a *minimum* of £5430 in Finland to a *maximum* of £49,257 in the case of England and Wales. It thus appears that in a country so remote as Finland, where materials would naturally be expected to be more expensive, the outlay per mile has been less than one-ninth part of that incurred in England, where materials generally are cheap.[1]

In the twenty-one countries tabulated in this statement, there have been constructed about 246,000 miles of railway, at a total cost of 4323¼ millions sterling, being an average of about £17,230 per mile. This average is only about a third of that found for England and Wales. If, however, the United Kingdom is entirely eliminated from the record, the total mileage constructed comes out as 227,000 miles, and the expenditure falls to 3537 millions sterling, being an average of about £15,200 per mile, or considerably less than one-third

[1] The conditions of the comparison here are, of course, hardly parallel. Finland is only given because it shows the *minimum* mileage outlay; but the land costs next to nothing, the permanent way is light, the railways are nearly all single line, the equipment is meagre—in a word, there is hardly any point of contact between the two cases.

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of the average cost incurred in England and Wales, and about one-half the cost incurred in Scotland.

It would take up too much time to endeavour to analyse the various causes that have brought about these remarkable differences. Nor is it necessary for our present purpose. We have to deal with the facts as they are; and the fact of an enormously higher expenditure on English railways, however much it may be a matter for regret, and however adversely it may be calculated to affect industrial prospects, must be treated not only as a fact, but as one incapable of remedy or amelioration.

Manifestly, the first and most permanent effect of the very much larger capital expended per mile open on English lines is that of requiring a considerably larger traffic to produce the same net profit as on lines that have been more economically constructed. An average net income of £608 per mile will pay a dividend of 4 per cent. (a figure that may be taken as the average dividend on railway investments) on the sum of £15,200, which we have found to be the average mileage cost of the railways of the world, excluding our own. But in order to pay the same rate of interest on English railways an average net income of £1968 per mile is necessary, while on the railways of the United Kingdom, as a whole (which have cost over £42,000 per mile), a net income of £1680 is necessary, or 176 per cent. more than the average required to pay the same rate of dividend on the railways of the rest of the world.

Here, then, is the determining factor of the English railway problem—a factor which is unalterable by any expedient or process short of the wiping off or extinction of a great part of this huge capital burden. Having the fear of the 400,000 British railway shareholders before our eyes, we are not quite prepared to counsel so drastic a remedy; and in now proceeding to consider the conditions under which railway undertakings are worked in different countries, we must regard the capital cost,

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and the requirements that it inevitably entails, as the governing pivot around which all the other essential facts revolve.

But if the capital expenditure on British railways has been phenomenally great, so also is the volume of their traffic and the receipts therefrom. To illustrate this fact, the following table has been prepared :—

Statement showing the Average Gross and Net Earnings and Working Expenses per Mile of Railway Open in different Countries (1883).

Countries.	Gross Receipts.	Net Receipts.	Per Cent.	Working Expenses.	Per Cent. of Gross Receipts.
Germany . .	£2226	£999	44.8	£1227	55.0
Belgium . .	2346	981	41.5	1365	58.2
France . . .	2716	1236	45.5	1480	52.5
Austria-Hungary .	1623	695	42.8	928	57.2
Italy . . .	1404	394	28.0	1010	72.0
United States [1] .	1296	488	37.7	808	62.3
United Kingdom	3477	1709 [2]	49.1	1768	50.9

It is not necessary to carry this comparison further, since the economic conditions of other European countries and the British colonies are so entirely dissimilar to those of British railways that further details could serve no practical purpose.

The question that is naturally presented for consideration, on looking at these figures, is—

"Since it is necessary that the net receipts from railway working in the United Kingdom should average over £1900 per mile, in order that shareholders may divide a profit of four per cent., since that average can

[1] In the case of the United States, the net receipts are distinguished from the "total available revenue," the latter amounting to 360 millions of dollars, and showing a net average of £598 per mile; the former amounting to 291½ millions of dollars, and giving a net income per mile open of £488, as above shown. It is also to be noted that the net earnings, as well as the gross, owe something to coal lands, &c., and other operations besides mere transport.

[2] The figures for the United Kingdom apply to the year 1885, when there was a diminution of both gross and net receipts per mile open, as compared with several immediately preceding years.

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only be arrived at by keeping up the present range of gross receipts or by reducing the working expenses, and since the maintenance of the present range of gross receipts involves the maintenance of a high range of rates and fares, how far is it possible to effect economy in the working expenditure, which is now very much higher per mile open than that of any other country?"

It is difficult to furnish an adequate reply to this question. The circumstances of every country and State are more or less peculiar to itself, so that there is no reliable standard by which to test the comparative economy or extravagance of British railway administration on an open mileage basis. If we apply the test of the quantity of traffic carried, we find that in Belgium, where the railways carry 13,172 tons of goods traffic per mile open, as against 14,376 for the United Kingdom, the working expenses amount to only £1365, or £403 per mile less than in our own country. In the State of Pennsylvania, again, which is the only other case at all comparable with our own, the volume of goods traffic carried per open mile amounts to rather over 16,000 tons, but the working expenditure also rises to £1900 per mile, or £114 more than that of the United Kingdom. In France, the volume of goods traffic only amounts to 5869 tons per mile, and yet the working expenses are within £288 of those of British railways, on which, as we have seen, 14,376 tons are carried per mile open.

It becomes necessary, then, to consider the several elements that compose the total cost of railway working under different circumstances. Those elements are of two kinds, the first varying according to the amount of the traffic; and the second, if not unvarying, at any rate so largely fixed as to be to a great extent independent of the volume of traffic carried.

To the first category belong the cost of haulage, or locomotive power, the maintenance of way, the repairs and renewals of rolling stock, and, to a much more limited

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extent, the item of traffic charges. In the second category (which includes administration, the keeping up of railway stations, &c., the payment of rates and taxes, the break and block systems, and so on) are usually reckoned the larger proportion of the item "traffic charges," together with "general charges" and "miscellaneous expenses."

These several items are tabulated, as regards the twelve principal railways in the United Kingdom, in Appendix B, the standard of comparison being the train-mile. In every case there appears to be a great amount of variation between the different companies, which is not to be explained by variations in the volume of the traffic transported, since the train-mile standard is, or ought to be, almost entirely independent of such variations. Thus, as regards the maintenance of way, the Great Western, with an expenditure of 6.90d. per train-mile, is 2.50d., or 57 per cent. higher than the Manchester, Sheffield, and Lincolnshire Railway, with an average of only 4.40d. This, however, may be due to the fact that in the particular year selected for comparison (1884), the Great Western laid down a larger, and the Manchester, Sheffield, and Lincolnshire a smaller, proportion of renewals than usual, so that it would hardly be fair to attach too much importance to differences appearing in this item.

It is not so, however, to the same extent with the element of locomotive power, which rises as high as 10.75d. per train-mile in the case of the North-Eastern, and falls to 7.13d. in the case of the Manchester, Sheffield, and Lincolnshire, showing an increase in the former over the latter of 3.60d. per train-mile, or 50 per cent. Now, both of these lines carry a very large volume of mineral traffic, and traverse almost contiguous districts. They are both on important coal-fields, and have thus the command of cheap fuel. Why, then, should there be this great difference? In so far as it is not due to mere prodigal expenditure, it may, of course, be referred to steeper gradients and heavier trains in the case of the less economical line; but on this point there is a lack of reliable *data*.

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The only other item which varies, or ought to vary, directly as the volume of traffic, is that of repairs and renewals of rolling stock. Here there are greater differences than we have found to occur in reference to either of the other two items that vary according to the amount of traffic; the North-Eastern, with an average of 4.35d. per train-mile, being 2.01d., or 86 per cent., above the London and North-Western, with its average of 2.34d. per train-mile. This remarkable excess, whatever its origin, does not appear to be due to any obvious differences in the conditions under which the traffic is carried on, since the North-Western carries almost as large a mineral traffic as the North-Eastern, and a considerably greater general merchandise traffic.

It is not, however, until we come to the item of traffic charges that we are confounded by the extent of the variations that occur on different lines. In regard to this element, we find that the Lancashire and Yorkshire line, with an average of 13.21d. per train-mile, is 4.71d., or 55 per cent., above the Caledonian system, which only expends 8.50d. per train-mile. The two systems have much in common. Both have a large mineral traffic, both traverse districts with exceptionally difficult gradients, both have the command of cheap fuel; and there is not an adequate explanation of the excess in the English line in the fact that wages are rather higher in Lancashire than in Scotland.

To the uninitiated, some of these details may possibly appear trivial, but their vast importance in relation to the economical management of railways may be appreciated by the fact that as between the average train-mile expenditure on "traffic charges" in the case of the Lancashire and Yorkshire Railway, and that occurring on the Caledonian, there is a difference which, if applied to the total train-mileage of the country, would represent rather over five millions sterling per annum. But there are greater differences even than this, for the Lancashire

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and Yorkshire, having a total train-mile expenditure of 35.53d., is 7.27d., or about 30 per cent. higher than the Midland Railway, which traverses an almost conterminous district, and this difference, on the whole train-mileage of the United Kingdom in 1884, would amount to a trifle over eight millions sterling, or just one-fourth of the total net receipts from railway working in the same year.

It is manifest, therefore, that there are very remarkable differences in the matter of economical working, as between the principal railways of the United Kingdom, and these differences are not explained by the not unnatural variations in the character of the traffic, by geographical considerations, by the higher or lower rate of wages, by the more or less expensive character of the fuel and permanent way materials. They co-exist on lines that have practically the same boundaries, if they do not quite run parallel to each other; and hence they suggest the expediency and the high probability of securing a greater margin of economy than appears to have been attained up to the present time.[1]

The unwisdom of venturing, however timidly, to express any opinion as to the future of railway expenditure, is shown in the fact that the Duke of Devonshire's Commission reported in 1867 that "it is not probable that any diminution of the principal items of charge can be anticipated," and that "an increase may be expected in the items of wages and materials." The Commission could not have anticipated that, within twelve or fourteen years, steel rails, which were then sold at £12 to £15 per ton, would have fallen to less than £5, and that other items would show an almost equal decrease of cost.

[1] The differences in the train-mileage expenses have been ascribed to the higher or lower proportions of return empties and shunting mileage, as well as to differences in gradients and in the cost of fuel and labour. But it is more than probable that the shunting mileage, which Mr. Barton Wright put at 70 per cent. of the whole train-mileage of the Lancashire and Yorkshire Railway, would be largely got rid of if the companies were to acquire the rolling stock of private owners now run on their several systems, and thus avoid the enormous trouble and expense of sorting.

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Equally impossible of prevision was the enormous rise of prices that occurred in 1872–74, and the subsequent remarkable reductions in all the chief items of working cost. The inflated prices of 1872–74 sent up the train-mile cost of working the railways of the United Kingdom generally from 2s. 6d. in 1870 to 3s. 8d. in 1874. Since then, however, there has been an almost continuous fall in the important items of maintenance of way, locomotive power, and repairs and renewals. It is believed by good authorities that we have reached the bottom limit of economical expenditure, and that there is not much likelihood of any further abatement of the present average of 2s. 8d. per train-mile. It must be confessed that appearance would seem to justify this conclusion. The cost of materials could hardly be expected to fall much below the present range of prices, and labour is an item that seldom suffers any considerable fall. These two items are the main factors in railway working, and must always remain so. On the other hand, however, economy of administration would be likely to be promoted by greater centralisation, and there is unmistakable scope for economy in the items of "traffic charges," "general charges," and "miscellaneous outlay," which are not necessarily functions of the extent of the business carried on.

Is there, then, no likelihood of any material improvement in the present economic condition of the railway interest? Are we to conclude that passenger fares and traffic rates are henceforth to be capable of no amelioration as a result of increased economy of working, or may we look forward hopefully to the future as likely to evolve from its inscrutable matrix, chances and changes that will tend to alleviate the present distressed condition of industry?

There are, we think, two directions whence highly important economic results may fairly be expected—results that are not only within the often deceptive range of probability, but are all but certain to take place

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within no distant period. The first is the adoption of fuller train-loads, alike of passengers and goods traffic; the second is the natural increment of such traffic, and the consequent receipt of higher gross earnings relatively to the working expenditure.

The first of these elements is of the greatest possible importance, and we need make no apology for dealing with it at some length. It presents two distinct aspects for consideration,—the first, that of how the train-mile receipts of one country compare with those of another; the second, that of the variations and tendencies of train-mile receipts in the same countries as between one period and another.

The average train-mile receipts of the principal European countries in 1883 were—

Germany . . .	6.58s.	per train-mile
France	5.53s.	,,
Belgium	4.22s.	,,
Italy	4.62s.	,,
Switzerland . . .	6.66s.	,,

—while in the United Kingdom the average was 5s. 1d. in 1883, and 4s. 10d. in 1885. In the United States the average train-mile receipts rise to 8s. 6d.

There does not appear to be any sufficient reason why the train-mile receipts of European countries should take so low a range. The problem is, however, an intricate and complex one, being affected by many different considerations, such as the character of the gradients and curves, the average length of the lead, the composition of the traffic, and the extent and character of the facilities demanded and enforced by competition.

In Great Britain, the railways labour under more serious disadvantages than are met with in most other countries in respect of the generally undulating character of the country, and the consequent mechanical and economic limitations imposed upon the average load capable of being transported in certain districts. This point is one of such importance that it has been seriously recommended that some lines should transfer all their heavy traffic to canals, and restrict their transportation operations

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to light loads and high rates of speed. It is hardly likely that any of our principal lines will abdicate their primary functions in this wholesale fashion; and it would probably benefit no one if they did, since healthy competition between railways and canals is a thing to be desired. But it is, all the same, a determining factor in the calculation of how great an average load may be transported on our principal lines with advantage.

Even, however, when we have allowed for the most severe gradients, the present system must be regarded as wasteful and extravagant. The great secret of economical working is to secure the greatest live or net load, relatively to the non-paying or tare load. A few figures will enable this fact to be appreciated.

An average passenger train, without a single passenger, may be taken as consisting of—

One engine, weighing	35 tons
One tender, „	25 „
Two truck vans „	12 „
Eight carriages „	64 „

—making a total of 136 tons of tare or dead weight that must be hauled whether the number of passengers on board be great or small. Now, if we assume that each passenger weighs one cwt., it is clear that in order to get a live or net weight equal to the tare or dead weight, we must have 2720 passengers to each train; but as the average number of passengers does not probably exceed 60 per train, it follows that the hypothetical average of 20 passengers to the ton would give only 3 tons of paying for 136 tons of non-paying weight, a ratio which, on the face of it, is little short of absurd. If the average number of passengers were raised to 300, it would only increase the weight to be hauled by 12, or, at the most, 15 tons, and the train-mile receipts from passenger trains in Great Britain, instead of being only 4s., as they were in 1885, would thus be three or four times as much.

It is to be lamented, however, that instead of increasing the average receipts per passenger train-mile, the

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railways of the United Kingdom have within recent years been diminishing their train-mile receipts, as the following table shows:—

Statement showing the Number of Train-Miles run by Passenger Trains, the Receipts from Passenger Traffic, and the Average Receipts per Train-Mile.

Years.	Passenger Train-Miles.	Receipts from Passenger Traffic.	Average Receipts per Passenger Train-Mile.
		£	s.
1872	92,995,324	22,287,555	4·7
1874	96,749,953	24,893,615	6.1
1876	105,918,921	26,163,551	4·9
1878	113,184,252	26,889,614	4·7
1880	122,548,258	27,200,464	4·4
1882	132,183,898	28,796,813	4·3
1884	143,144,694	30,030,450	4·1
1885	146,458,206	29,773,022	4·0

We have now to distinguish between the train-mile receipts of goods and passenger trains, since there may be, and indeed generally are, very important differences between them. This will be made sufficiently clear from the following tabular statement, which compares the total train-mile receipts of different countries with the train-mile receipts from goods traffic alone:—

Statement showing the Average Train-Mile Receipts of different Countries in 1883, and the Receipts from Goods Traffic, as such.

Countries.	Average Train-Mile Receipts, all Sources.	Average Train-Mile Receipts from Goods Traffic.	Average Train-Mile Receipts from Passengers.
	s.	s.	s.
Germany . . .	6.85	9·3	3.8
Austria-Hungary . .	9·3	12.3	5·4
Belgium	4·22	6.1	2.7
France	5·53	10.9	3·3
Italy	4·62	8.1	4·5
Luxembourg . . .	4·2	...	...
Russia	10.6	12.0	8.0
Finland	...	7.0	...
United States . .	8.00	8.9	4.6
Canada	4·49	...	...
India	10.4	10.8	8.6
United Kingdom (1885).	4.8	5.6	4.0

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In most countries, therefore, the train-mile receipts from goods traffic are above those from passenger trains, and in every country named, except Holland, the goods traffic receipts are higher than those of the United Kingdom. This is not due to the higher range of traffic rates in foreign countries. On the contrary, there is hardly any foreign country that does not enjoy lower rates than England; and when this circumstance has been taken into account, it makes the case of British railways appear still worse, seeing that the train-mile averages may be brought up by higher rates, as well as by heavier net loads.

We have no direct clue to the average weight of the live or paying load carried on British lines. Some railway authorities place the average at 70 tons; others place it at a higher or a lower figure. Mr. Price-Williams has recently submitted for the author's consideration a calculation on the basis of an average load of 100 tons for ordinary merchandise trains, and an average load of 250 tons for mineral trains, which is herewith reproduced:—

England and Wales—

		Average Lead.	Train-Miles.
Goods tonnage $\frac{64,542,283}{100}$	= 645,422		
Add empty return 10 per cent. = 5 per cent. on total trains	32,271		
	677,693	× 94.50 miles =	64,042,088
Mineral tonnage $\frac{155,432,872}{250}$	= 621,731		
Add 90 per cent. return empties = 45 per cent. on total trains	279,799		
	901,511	× 47.33 miles =	42,668,515
			106,710,603
Actual train-mileage, as given in Board of Trade Returns			106,977,533

Now, although this hypothetical estimate appears to agree very closely with the actually ascertained mileage,

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as given in the official reports, we are disposed to believe that it is exaggerated as regards both the average load and the average length of lead. The gross receipts per ton give us a clue to the one—the average lead; and the average train-mile receipts give us a clue to the other—the average weight of the load. The average receipts per ton carried on the railways of the United Kingdom in 1885 were—

	s.	*d.*
For mineral traffic	1	8
„ general merchandise . . .	5	6

It appears to be tolerably evident that if we assume an average mineral rate of ½d. per ton per mile, in order to make the most ample provision for meeting the estimate of Mr. Price-Williams, we should only have an average lead of 40 miles; but since it is well known that a very large proportion of the mineral traffic of this country is not carried at less than 1d. per ton per mile, the average rate will probably be nearer that figure than ½d., which would reduce the average lead to about 20 miles, instead of 47.33. For general merchandise, the average ton-mile rate is between 1½d. and 2d. If we adopt the lower figure, the average length of lead will come out as about 50 miles. This figure is, however, largely conjectural.

As regards the average weight of the load hauled, the train-mile receipts appear to be equally adverse to the estimate of Mr. Price-Williams. The official figures for 1885 are 5.6s. per train-mile for both goods and mineral traffic, the train-mileage of each not being separately distinguished. Now, whatever may be the average rate charged for the transport of goods and mineral traffic in this country, it is certainly not *under* a penny per ton per mile; and if we adopt this figure as the closest approximation possible in the absence of those exact and

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specific returns of ton-mile rates which are obtainable for most other countries, the average load carried would come out as about 70 tons. It is, however, necessary to make a liberal allowance for return empties and shunting operations. What this allowance ought to be, probably no two railway authorities are quite agreed; but if it is assumed as 20 per cent. of the average calculated mileage, it would only result in bringing up the average load 82 tons, instead of the 100 tons estimated by Mr. Williams.[1]

It has been necessary to dwell at considerable length on these matters of detail, which, however trivial and uninviting they may appear, really lie at the root of the whole question of railway rates and charges. The higher rates generally imposed by British railways are justified by railway directors on the ground that the average length of lead in this country is very much less than in Continental countries, and that there is consequently a very great deal more expense involved in handling the traffic, the cost of which is practically unaltered whether the distance over which it is transported be long or short. There is undoubtedly some ground for this contention; but, as the following figures show, the average receipts from goods traffic in this country, per ton transported, are not so much below those of other countries as railway apologists would sometimes have us believe.

[1] It is probable that 20 per cent. is considerably under the allowance that should be made. Each railway company, however, is likely to have its own returns of paying and shunting mileage, and can apply them to the solution of the problem as regards itself.

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Statement showing the Tonnage of Goods Traffic Transported in different Countries, the Total Gross Receipts therefrom, and the Average Receipts per Ton.

Countries.	Receipts from Goods Traffic (£1 = 1000).	Tonnage Carried (1 = 1000).	Average Receipts per Ton.
	£	tons.	s.
Germany	32,914	183,808	3.58
Austria-Hungary	18,249	64,754	5.64
Belgium	3,649	27,640	2.64
Denmark	263	1,148	4.58
France	30,236	96,822	6.25
Italy	4,325	11,598	7.46
Luxembourg	91	1,925	0.95
Norway	183	1,050	3.50
Holland	913	5,939	3.07
Roumania	572	1,396	8.19
Russia	26,295	44,067	11.93
Switzerland	1,447	6,366	4.55
Totals and average	119,137	446,517	5.34
United States	108,902	400,453	5.4
United Kingdom—			
Mineral traffic	16,255	189,485	1.72
Merchandise	22,421	76,899	5.83
All goods traffic	38,701	266,382	2.90

It appears, then, that if we take the total goods traffic of the United Kingdom, and compare it with the total goods traffic of Continental Europe, the average receipts per ton transported come out as little more than one-half of the Continental average. But if we compare the receipts from general goods and merchandise traffic (excluding minerals), the average of Great Britain is *higher* than the average shown for Continental Europe from goods traffic as a whole.

Which of these two standards of comparison is the fair one? The United Kingdom occupies, in regard to mineral traffic, an unique position. As we have just seen, our railways carry a larger volume of mineral traffic

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alone than the total goods traffic of all Continental lines put together. We have, at the same time, a larger volume of merchandise traffic than any other European nation, our general goods traffic alone exceeding the total traffic of every Continental country, excepting only Germany and France. We have not the necessary elements of an exact comparison of the general merchandise traffic of different countries, as distinct from minerals, since the two descriptions of traffic are not separated in Continental traffic returns, as they are in those of our own country; but a tolerable knowledge of the mineral resources and productions of different European nations justifies the opinion that in no other country, except Germany and Belgium, will *mineral* traffic form anything like one-half of the *whole* traffic carried. From this general observation Luxembourg should be excepted, since that Duchy has an almost exclusively mineral traffic, and the average receipts per ton transported are not one-third of what are earned over the whole goods traffic of the United Kingdom.

Since, however, Germany and Belgium are the nations that have most in common with our own, since they have, like Great Britain, a very large mineral traffic, since they are our most active and successful industrial competitors, and since they are the standard by which our own railway system is most frequently compared and judged, it is desirable that we should take special notice of the fact that their average tonnage receipts, considered as a *whole*, are scarcely in excess of those found for the United Kingdom; thus—

In Germany, the average tonnage receipts amount to 3.58s., or 0.68s. per ton above those of the United Kingdom.

In Belgium, the same average amounts to 2.64s. per ton, or 0.26s. under the average of the United Kingdom.

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In Holland, the same average amounts to 3.07s. per ton, or 0.17s. above that of the United Kingdom; while

In Luxembourg, the average is 0.95s. per ton, or 1.95s. under that of the United Kingdom.

In view of these facts, what becomes of the contention that the average length of lead is shorter, and the average receipts per ton carried are much lower, in the United Kingdom than in other European countries? The fact is, that if we bring the different European countries to the standard of general merchandise traffic only, disregarding minerals altogether, it will most probably be found that the British average is above that of every country in Europe except France, Italy, and Russia. It may be, and probably is, the fact that the length of lead in Great Britain is generally shorter, but we have now seen that the railways take good care not to suffer by such a circumstance.

In all the leading countries of the world there has, within recent years, been a tendency towards a reduction of the average receipts per ton carried. This tendency is not likely to be so much a result of a diminished lead, as of a reduction in the cost of transport. The following statement shows the gross railway receipts per ton carried at different dates:—

Countries.	Average in 1874.	Average in 1884.
United Kingdom—	*s.*	*s.*
Mineral traffic . .	1.9	1.7
Merchandise . .	5.9	5.5
France	8.7	6.8
Belgium	2.4	2.3
Prussia	4.0	3.4

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It would be interesting to discover how much of the reduction shown for the United Kingdom, if any, is due to abatements in rates, and how much, if any, is due to variations in the average length of lead. We are unable, however, to throw any light upon these points.

We have already seen that one of the first and most startling characteristics of railway statistics is the enormous difference that occurs in the cost of construction, even in cases and under circumstances where the conditions to be met appeared to be more or less parallel to each other. Another distracting feature is the increase or decrease of capital cost per mile open, as between different periods.

Appendix C shows the average cost per mile of railway in the principal countries of the world between 1874 and 1884. It will be noted that in the United Kingdom, Germany, the United States, and Belgium there has been an increase of cost per mile open, while in France, Austria, Hungary, and Italy there has been a decrease. The results are summarised in the following tabular statement:—

Average Cost per Mile of Railway Open in different Countries in 1874 and 1884, with Amount of Increase or Decrease in the Latter Year.

Countries.	Average Cost per Mile in		Increase or Decrease in 1884.	
	1874.	1884.	Increase.	Decrease.
United Kingdom . .	£37,078	£42,486	£5,408	...
Germany	19,860	21,100	1,240	...
France	32,030	27,550	...	£4,480
Italy	19,790	19,436	...	354
Belgium	23,000	25,385	2,385	...
Austria	22,560	20,030	...	2,130
United States[1] . . .	12,360	12,792	432	...
Averages . .	£23,090	£24,168	...	...

[1] These are the averages got by dividing the mileage into the nominal capital for each year, but Mr. Poor calculates that the real average cost of construction and equipment of all the railroads in the United States at the end of 1883 did not exceed £6000 to £6500 per mile. In other words, the fictitious capitalisation was nearly one-half of the whole.

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There can be little doubt that the greater cost of British railways, up to a certain point, has been fully justified, or, if not justified, is capable of easy explanation. The heavy expenditure which has been entailed by land purchase, by Parliamentary contests, by the more substantial character of the works and ways, and the greater cost of British labour, has no doubt contributed to this result. But it is by no means equally obvious why these several influences, important though they be, should have involved us in an average expenditure per mile constructed that is nearly four times as much as that of American railways, and more than twice as much as that of the railways of Germany, Italy, and Austria-Hungary. It is still less manifest why English railways should go on adding to the difference in capital cost that had already sufficiently distinguished them from the railways of other countries. This increased average mileage outlay may, no doubt, be defended on the ground that it has been entailed by the necessities of the traffic, or by the reiterated demands of the general public. But even this plea, good though it be up to a certain point, is hardly an adequate one, since the traffic of other countries has been developed concurrently with that of our own, and in some cases to a still greater extent, without having involved the same enormous increase of capital outlay on already existing lines.[1]

In order that the latter fact may be adequately appreciated, two tables have been prepared (B and C) which show the graduated development of goods and passenger traffic in the principal countries of the world since 1874. These tables are summarised in the following—

[1] *Vide* Chapters III. and XXIII. for additional *data* and observations on this subject.

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Statement showing the Volumes of Goods and Passenger Traffic carried on the Railways of different Countries in 1874 and 1884.

Countries.	Goods Traffic (1 ton = 1000).		Increase in 1884 (1 ton = 1000).	Passengers Carried (1 = 1000).		Increase in 1884 (1 = 1000).
	1874.	1884.		1874.	1884.	
United Kingdom .	188,539	259,327	60,788	477,840	694,991	217,151
Prussia .	89,298	145,000	55,722	109,570	167,170	57,600
France . .	58,932	89,056	30,124	121,117	207,171	86,054
Italy . .	6,700	11,905	5,205	27,320	36,817	9,497
Belgium .	25,620	35,609	9,989	45,164	64,460	19,290
Austria .	39,950	70,942	30,992	41,955	50,254	8,299
United States	200,000	390,875	190,075	190,000	360,600	170,000
Totals and average	609,019	1,001,898	382,899	1,012,966	1,581,463	568,497

According to these figures, it would appear that there was an increase of 382 millions of tons, or 66 per cent., in the volume of traffic carried within the period dealt with, and an increase of 568½ millions, or 56 per cent., in the number of passengers transported. This may be accepted as convincing evidence of the steady development of both descriptions of traffic; and upon this fact we are entitled to base a hopeful view of the future. It may be that the development over the last twelve years has been much more considerable than we need expect to see continued. The statistical history of British railways would appear to support such a conclusion. Between 1854 and 1864 the average gross income from British railways increased from £2510 to £2660, or £150 per mile of line open. In the next ten years the increase was £799 per mile of line open, and during the ten years ending 1884 there was only an increase of £130 per mile of line open; so that, as tested by the movement of traffic over decennial periods, the increase has been inconstant.

The increase of traffic in the United States has, how-

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ever, been more remarkable than anything that has occurred elsewhere, and it may therefore be cited as a notable example of what a judicious policy, designed to stimulate traffic by working on a very narrow margin of profit, is capable of bringing about. The average gross receipts per mile open in that country have been—

In 1871	£1390 per mile
„ 1875	1409 „
„ 1880	1400 „
„ 1883	1424 „

Now, these figures mean a great deal more than appears on the surface. They would have been sufficiently remarkable if they had been the outcome of the same average range of rates and charges over the whole period dealt with, considering that in this interval the mileage of railway open had been more than doubled—that is to say, it had increased from 60,522 to 125,152 miles. But within the same period the average transportation or freight charges on American lines as a whole had been decreased by one-half or even more, so that the same mileage revenue in the period 1880–83 would represent fully double the volume of traffic;[1] in other words, if the same rates had been charged in 1883 as in 1871, the average gross receipts per mile would have amounted to nearly £3000 per open mile, instead of the £1424 which we have ascertained it to have actually been.

The facts and considerations already put forward have now brought us face to face with the difficult problem of rates and fares, the means whereby they have been or may be reduced, the results that have generally followed their reduction, and the character and extent of their incidence in various countries.

[1] This is not strictly the case as regards the tonnage carried, which was 2650 tons per mile in 1871, and 3322 tons in 1883; but the average distance over which each ton was transported in the latter year was considerably greater, which comes to much the same thing.

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Let us not seek to mince matters. The average transportation charges may be ascertained for every European country except England as regards both goods and passenger traffic. In Great Britain, the railways, whether by accident or by design, have hitherto contrived to make it impossible for the public to discover the average charges for the transport of either the one or the other, for any one railway, or for the country as a whole. The missing link in the chain of evidence—a link which is not withheld in any other leading country—is *the number of passengers, and the number of tons of goods and mineral traffic, transported one mile.* Such *data* are supplied as regards Australian and Indian railways.[1] They are withheld as regards Great Britain. If, therefore, the railway companies, or any of them, were to assert that the average ton-mile rate is under a penny, we are not in a position to furnish absolute proof to the contrary. We are, on the contrary, altogether in the dark as to whether it is more or less. All we do know is, that such concrete examples as may be found by

[1] There are several important features in Indian railway accounts that it would be worth while to imitate in England. They show, among other features, the number of passengers carried one mile, distinguishing the several classes, and the number of tons of goods traffic moved one mile, distinguishing the different descriptions of merchandise, such as general merchandise, military stores, railway materials for constructive purposes, coal, live stock, &c. The Indian railway accounts further show the number of carriages of each description employed on each line, which is important as affording the means of judging how far the several descriptions of passenger traffic pay or otherwise. As it is at present, there are no adequate means of estimating whether the passenger traffic of the United Kingdom is not carried on very largely at the expense of the goods traffic, and especially whether the expense of running first-class carriages, that are generally more than half empty, is not a source of loss. If, however, the total number of carriages of each class was specifically stated for each country, together with the total train-miles run, and the total receipts, it would be a comparatively easy matter to calculate the factor just referred to. In regard to some leading lines, these *data* are given in the half-yearly reports; but they ought to be given in the official reports of the Board of Trade for the country as a whole.

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thousands in recently published reports,[1] justify the view that it is considerably more.

That they manage these things better in the United States is a fact that we cannot afford to ignore. With regard to a number of the principal railways in that country, we have access not only to the average transportation charges per ton per mile, but to the average working expenses and the average net receipts as well. We cannot well exaggerate the importance of this information. If it were available for Great Britain, or even for one or two of the principal lines, it would go a long way towards settling some great problems that have hitherto appeared to be all but insoluble.

The charges made for the transport of goods traffic, with the operating expenses, and the net receipts, per ton per mile, as between the years 1870 and 1880 were, as regards some of the principal American railways, as follow :—

Railways.	Receipts.		Expenses.		Profits.	
	1870.	1880.	1870.	1880.	1870.	1880.
	d.	*d.*	*d.*	*d.*	*d.*	*d.*
Pittsburg and Fort Wayne	0.72	0.45	0.43	0.25	0.29	0.20
Pennsylvania . . .	0.77	0.44	0.49	0.23	0.27	0.20
New York, Lake Erie, and Western . .	0.66	0.42	0.48	0.26	0.18	0.15
New York Central and Hudson River .	0.92	0.44	0.58	0.27	0.35	0.17

These being four of the principal lines in the United States, and carrying collectively nearly one-sixth of all the goods traffic of the country, it is fair to conclude that their action and experience have been typical of those of American railways generally.

These charges have, of course, been varied from time to time, but they may be taken to fairly represent the

[1] Especially the Appendix to the Report of the Select Committee of 1881 on railway rates and charges.

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averages of the same lines since 1880. In some cases, indeed, the rates have been still further reduced since that time, as, for example, in the case of the New York Central, where the average transportation rate for traffic of all kinds was in 1885 only 0.34d. per ton per mile, a figure which is probably less than one-third of the average of the rate charged for goods and mineral traffic in our own country.

What have these remarkable changes in the relations of the railways and the people accomplished for the latter? According to Mr. Edward Atkinson, who has written with remarkable force and intelligence on the economics of this subject, the aggregate receipts from goods traffic in the United States for the years 1883–85 have reached 106 millions sterling per annum; whereas, at the average rates charged by the New York Central Line in the period 1865–69, the annual gross total would have amounted to 250 millions. These figures mean, therefore, a difference of about 144 million pounds sterling a year saved to the people of the United States in the cost of moving food, fuel, and the materials for shelter and clothing.[1]

We can imagine some of the English railway directors rubbing their eyes on looking at these figures, and interrogating themselves after the manner of Bret Harte's hero:—

"Do I sleep, do I dream,
Do I wander in doubt;
Are things what they seem,
Or are visions about?"

And it must be fairly confessed that the facts are so astounding as to justify some fear of error; but facts they are, nevertheless.

So far as a judgment may be formed on the average receipts per ton of minerals and merchandise transported,

[1] In these calculations the dollar has been converted at 4s. These figures, as calculated by Mr. Atkinson, are forty-four millions more than those given at p. 318, *ante*, but they refer to a later date, and manifestly, as the area of operations is extended, so also will be the amount of the annual savings.

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it would appear that, in the case of British railways, there has been a slight abatement of rates within the same period. But the reduction is very trifling; and since it *may* be due to the shorter average distance over which the traffic has been carried, it would be a mistake to attach great importance to it.[1]

As we have already seen, the average length of lead in this country may be calculated at twenty miles for minerals and fifty miles for general merchandise, allowing 1d. per ton per mile for the former and 1½d. for the latter. Assuming these figures to be correct, the ton-mile traffic of the United Kingdom in 1885 would come out as—

3,675,534,000 ton-miles for mineral trains;
3,675,805,000 „ „ merchandise trains;

making a total of 7,351,339,000 tons carried one mile.

In the United States, the ton-mile movement of traffic is much greater than this, amounting as it did, in 1884, to 44,065 millions of ton-miles. The gross receipts from this traffic amounted to 544½ millions of dollars, being an average of 0.62d. per ton per mile transported.

If we divide the ton-mileage calculated for the United Kingdom into the £36,871,945 receipts from goods traffic in 1885, the average cost per ton per mile comes out as 1.2d.,[2] being just about double the average ascertained for the United States.

The railway returns for the United Kingdom do not separate the proportions of working expenditure due to passenger and goods traffic expenses respectively. All that we are told is, that the total working expenditure for traffic of all kinds amounted in 1885 to 36¾ millions

[1] Between the years 1872 and 1883, inclusive, the average receipts per ton of merchandise carried on the railways of the United Kingdom fell from 6.9s. to 5.5s., being a difference of 1.4s., or 20 per cent. Within the same interval the receipts per ton of minerals carried fell from 1s. 11d. to 1s. 8d. per ton, a reduction of only 3d., or 13 per cent.

[2] This is, however, likely to be under the real figure, which should not be put too high, lest we should do the railways an injustice. At p. 320, the average is taken as 1½d. per ton per mile.

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sterling. If, however, the average working expenditure for goods traffic had been the same as that ascertained for the four leading American lines already referred to—that is, about 0.25d. per ton per mile—the total outlay involved in the actual transport of the 7351¼ millions of ton-miles calculated for the United Kingdom in 1885 would have been £7,700,000.

This last figure is necessarily modified by the necessities imposed upon the railway companies in reference to the running of return empties. Mr. Price-Williams has calculated that 90 per cent. of the mineral and 10 per cent. of the general merchandise trains must be included in this category. How to deal with these qualifying figures is, even to experts, a veritable *pons asinorum*.

We cannot assume that the transport of the return empties is so expensive a matter as the transport of the corresponding live load, since the gross weight is much less and there is no expense incurred in handling. It will not do, therefore, to add 90 per cent. to the mineral and 10 per cent. to the merchandise ton-mileage, which would appear to be the shortest cut to the desired result. It is probable, indeed, that 40 per cent. all round would be a sufficient allowance for return empties; but this figure is necessarily empirical, and must be taken for what it is worth. If it is approximately correct, we should find that the total cost involved in working the goods traffic of this country, at the ascertained rates of leading American lines, would amount to £10,780,000; and as the total gross receipts from goods traffic amount to about thirty-seven millions sterling annually, the profit from this source of revenue ought to be highly respectable. Railway directors are, of course, not likely to admit that the cases of British and American goods traffic are at all parallel, and to a large extent they are right. The main difference is the greater length of lead in the United States, which is perhaps three times that of our own country. But in nearly every other respect, the conditions of working are

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capable of being made much more parallel than they are at present. The means that have enabled the American lines, as we have seen, to reduce the cost of working, per ton-mile, by something like one-half within a period of ten or twelve years, are surely equally open to, and capable of being applied by, British railways. There is no very manifest reason why the railways of this country should not, like the American lines, adopt much larger train-loads, reduce the tare weight relatively to the live-load, get a much greater annual mileage out of their rolling stock, and adopt other economies that have tended to make American lines what they are at the present day. The exceptionally large mineral traffic carried on British railways, is, indeed, peculiarly favourable to the adoption of most of these sources of economy.

So far as the nations of Continental Europe are concerned, we have no need to go into details. Suffice it to say that the average ton-mile rates in Belgium, Germany, and Holland are much under our own, and these are the nations from whose competition we appear to have most to fear.[1]

There is likely to be a doubt in the minds of not a few as to the possibility of the railway corporations of the United States making the enormous reductions of rates to which we have referred consistently with the maintenance of solvency. This is unquestionably a fair point to raise, and we have endeavoured to anticipate the possible objection by making an analysis of the railways of each State, showing the total nominal capital, the total cost of the road and its equipment in each case, the gross and net earnings, and the percentage of the net earnings on the actual cost of the lines. On examining

[1] The average rates for the transport of minerals and merchandis together, as shown elsewhere, were, in 1883—

In Germany,	0.85d.	per ton	per mile.
„ Belgium,	0.77d.	„	„
„ Holland,	0.76d.	„	„
„ Luxembourg,	0.95d.	„	„

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this statement, which will be found in Appendix F, it will be seen that in fifteen States the net earnings in 1883 were equal to paying a dividend of 5 per cent. and upwards on the cost of the construction and equipment of the lines. In sixteen other States, the receipts varied from 3 to 5 per cent. on the same cost; and in only eight States or Territories were the net earnings insufficient to pay 3 per cent. on such cost.[1]

The question is not infrequently raised whether goods or passenger traffic is the more remunerative. The conditions under which the two descriptions of traffic are carried on vary so greatly that it is quite possible to conceive of one yielding a large profit, while the other may result in a loss. Some have contended that passengers are a much more considerable source of profit than merchandise, on the ground that, relatively to the weight carried, a much higher price is charged for passenger traffic. This is, no doubt, in some degree the case. A ton of passengers will represent from fifteen to twenty travellers at an average of not less than a penny per mile, so that passengers, weight for weight, will probably yield from nine to twelve times the receipts that are derived from goods traffic. But it must not be forgotten that in working passenger traffic the expenses are much greater; that the net or paying load carried is always much less, relatively to the gross load; and that the higher average rate of speed compels a much higher cost for maintenance, &c., relatively to results.[2] Hence, in many cases, it costs more to transport a single passenger one mile than it does to carry a ton of traffic the same distance.

[1] It is important to distinguish between the actual cost of the road and equipment and the total nominal capital, since the latter is often very largely made up of "watered" stocks, which form no necessary part of the cost of the undertakings. This subject is also referred to at p. 323.

[2] A recent report of the Pennsylvania Railway Company shows that the earnings per passenger per mile average 1.12d., as compared with 0.44d. for a ton of goods traffic; the working expenses, 0.80d., as compared with 0.27d.; and the net receipts, 0.33d., as compared with 0.20d.

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On the other hand, however, it should be observed that the mineral traffic usually occupies the line for a much longer period than the passenger; that the passenger carriages are, or ought to be, always running, while mineral and merchandise wagons are, perhaps, less than half their time in motion; and, finally, that minerals and merchandise involve a great deal of labour in loading, unloading, covering, collecting and delivering, &c., whereas passengers load and unload, collect and deliver, themselves.

But whether passenger traffic as a whole, or goods traffic as a whole, is the more remunerative, it is easy to show that, so far as passenger traffic is remunerative at all, it is so mainly, if not entirely, as regards the third class. This fact may be tested by an examination of the financial results of working first and third class carriages on the Midland and Great Western Railways, which are not usually regarded as badly-managed lines. The official returns of receipts on these systems from first, second, and third class traffic, and the average numbers of passengers carried by each description of carriage, show the following results:—

	Midland Railway.		Great Western.	
	1876.	1885.	1876.	1885.
Average receipts per carriage—				
First class	£613	£330	£711	£513
Second class	...	...	1,113	973
Third class	775	885	1,097	1,038
Average number of passengers carried—	Number.	Number.	Number.	Number.
First class	4,195	1,944	3,938	2,800
Second class	...	...	12,950	11,106
Third class	16,000	17,765	23,068	21,647;

These figures may or may not be corroborated by those that would be brought out by a similar analysis of the accounts of the other leading companies. It is, however,

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more than likely that they are only typical of the country as a whole. In the absence of details of the numbers of carriages of each class on Continental lines, we are unable to make any comparison of one country with another.

Such as they are, the figures show the following remarkable facts as regards the Midland Railway:—

That between 1876 and 1885 the average receipts from each first-class carriage decreased by £283 per annum, or 46 per cent.

That in the same interval the receipts from each third-class carriage increased by £110, or 14 per cent.

That between 1876 and 1885 the average number of passengers carried in each first-class carriage decreased by 2251, or 54 per cent.

That within the same interval the average number of passengers for each third-class carriage increased by 1765, or about 10 per cent.

That in 1885 each third-class carriage earned nearly three times as much as each first-class, and carried nine times as many passengers.[1]

Another important fact that appears to be clearly established by these figures is that second-class carriages are a greater source of profit than first-class, and not far short of being as remunerative as carriages of the third class. It will be observed that on the Great Western Railway the average receipts per second-class carriage fell from £1113 to £973 per annum between 1876 and 1885, while first-class vehicles show a concurrent fall from £711 to £513. At the latter date each second-

[1] Both the Midland and the Great Western Railways have a large number of composite carriages. These introduce a disturbing element, which has been dealt with by dividing the composites equally between first and third class in the case of the Midland, and between first, second, and third-class in the case of the Great Western. This division is not likely to be perfectly accurate, but the limits of possible error will not be very wide.

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class carriage had earned £460 per annum, or about 90 per cent., more than each first-class carriage, which does not appear to support the often-expressed opinion that second-class vehicles are infinitely less productive, and ought, therefore, to be abolished. That this is not the opinion of railway managers generally is shown by the limited extent to which the example of the Midland, in getting rid of the second class entirely, has been followed.

It may not be deemed irrelevant to the purpose of this chapter if we make some observations in reference to the subject of railway statistics—not in a carping or fault-finding spirit, but with a view to the friendly consideration of those concerned.

It cannot be said that the summary of railway statistics with which the British public is supplied by the Board of Trade in the annual "Statistical Abstract of the Principal and other Foreign Countries" is quite what it ought to be. On the contrary, it is extremely difficult to make such a use of the figures given as to establish anything like reliable comparisons of one period or one country with another. The returns of no two countries are constructed on the same plan, and it looks as if each table had been drawn up by a different abstractor, without any reference to the control of a superintendent whose business should be to see that there is at any rate some degree of parallelism and uniformity in the figures. Nor is this all. The figures for the same country are not constructed on the same plan from one year to another. Thus, in the case of the United States, we find in the "Abstract" for 1879–80 that the second item in the table is "the distance travelled by locomotives, but in that for 1884 no such entry occurs. In the former year, we have the total working expenses; in the latter, nothing of the kind. Many similar cases might be cited.

What is now more particularly required is, that the

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Board of Trade should undertake the consideration of how far the *data* recorded in the "Statistical Abstracts" can be tabulated on an uniform plan. There is no real difficulty in the way of accomplishing this result. All the railways in Europe now keep their accounts on a tolerably uniform system, so far as essential *data* are concerned. They all show—

1. The cost of construction.
2. The gross and net revenue.
3. The rolling stock employed.
4. The number of passengers carried and receipts therefrom.
5. The tons of goods carried and the receipts therefrom.
6. The ton-mile passenger and goods traffic.
7. The working expenses.
8. The percentage of net receipts on cost of construction.
9. The number, causes, and results of accidents.

And many of them, especially the German and Belgium lines, furnish much fuller information still. But if the foregoing details were recorded for every country dealt with in the "Statistical Abstract," there would be no need to complain of want of essential facts, since no further details would be required to enable railway authorities and shareholders to get at the actual circumstances of the railways of each country.

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CHAPTER XXXII.

PENDING PROBLEMS.

Classification of Goods.

One of the most constant sources of complaint and irritation on the part of traders is the absence of uniformity in the classification adopted by the different railway companies. This matter is, in truth, in a most confusing and unsatisfactory state, since scarcely any two companies adopt precisely the same classification for their own purposes, although there is a clearing-house classification common to all; and in every case articles are classified without any obvious rule or principle in reference to their weight, their bulk, their value, their destination, or their characteristics otherwise.

These facts have from time to time occupied the attention of several Select Committees and Royal Commissions. They are ever present to the trading public, and they have long called loudly for amendment, although hitherto without effect.

The usual classification adopted provides for five ordinary classes, and a special and mineral class as well. The clearing-house classification is arranged on the same plan, and includes something like 2000 different articles, but it is liable to be varied and revised from time to time, so as to bring it up to the requirements of the day.

When a railway company is desirous of making a special rate for some particular article included in one of the five classes, it makes an agreement with the other companies

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over whose line the article is to pass, and then notifies to the clearing-house that the article is placed in the special class so far as those railways are concerned, or moved to a different class from the clearing-house classification.

The Royal Commission of 1867 expressed the opinion "that the clearing-house classification should be made the basis of the classification adopted in Acts of Parliament. The enumeration and classification should be stated at length in a general Act. It would then only be necessary in the special Acts of the railway companies to refer to the general Act, and to enact the maximum tolls or charges applicable to each class, instead of imperfectly enumerating articles in each class, as is now done. If, however, the circumstances of any particular railway, or of the district in which such railway is situated, should render it expedient that the rate on any enumerated article should be different from that necessary for the other enumerated articles in the same class as prescribed in the general Act, it should be mentioned in the advertisement required by the standing orders before introducing the Bill. It would then rest with Parliament to decide whether it would allow a departure from the general Act. Existing railway companies, in whose Acts of Parliament the classification is essentially different from the clearing-house classification, should apply for short Acts of Parliament to arrange their existing maximum tolls as nearly as possible to meet the new classification. It would still be competent for companies to vary their charges within the limits of the maximum prescribed by the special Acts."

These recommendations have up to the present time remained a dead letter. The subject meanwhile has not been permitted to sleep entirely. It occupied a large share of the attention of the Select Committee of 1882, which made a report that was practically an echo of that of the Devonshire Commission fifteen years before, remarking that "the classification of goods is very imperfect,

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and no uniformity in rating is observed, either as between the Acts of different companies, or among the various special Acts of the same company." They added that "almost every railway company levies rates under several Acts, applicable to different portions of its system, and in some cases reference must be had to more than fifty Acts to determine the various rates the company is authorised to charge;" that "it is usually provided that all articles not enumerated"—of which there are many—"may be charged at the highest rate authorised;" and that "it is thus extremely difficult for a trader to discover on an extensive system the maximum legal rate for the conveyance of any particular kind of goods."

In the session of 1885 a number of the leading British railway companies introduced into Parliament Bills that were intended, among other things, to meet the recommendation of the Select Committee of 1882, "that one uniform classification of goods be adopted over the whole railway system." The opposition that was offered to these Bills was so great that they had to be withdrawn; but they are nevertheless important as indicating the views entertained by the railway interest respecting the classification that it is desirable to adopt. That classification provided for two mineral classes, one special class, and five ordinary classes. In the two mineral classes about fifty-six different commodities were enumerated; in the special class, about three hundred; in the first class, about three hundred and sixty; in the second class, about four hundred; in the third class, about five hundred; in the fourth class, about two hundred and eighty; and in the fifth class, less than two hundred. The total number of articles enumerated was thus a little over two thousand, but it is needless to add that even this classification laboured under the defect of leaving many commodities unclassed, and therefore liable to be charged at the highest rate. The grouping of the different articles, moreover, left much to be desired. Those which were similar in character were not

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enumerated in the same class. Why, for example, should cement be placed in the mineral and asphaltum in the special class? Or why should bog ore for gas purifying be placed in the former, and ores of antimony, copper, and lead in the latter? Or, again, why should carrots find their way into the special, and parsnips into the first, class? Similarly egregious anomalies might be multiplied *ad infinitum.*

On a survey of the whole matter, it appears to be desirable that the Board of Trade or the Government of the day, in dealing with this question, should call in the aid of experts in each of the different industries of which either the raw materials or the manufactured products require to be classified, and make the classification arrangements, with their special knowledge, a matter of negotiation with the railway companies. It would seem as if the railway companies themselves had more to gain than they are likely to lose by such an arrangement. It cannot be to their permanent interest, scarcely even to their immediate advantage, to perpetuate any serious cause of friction and dispute with their customers. How can it possibly affect their ultimate interests whether carrots and parsnips are placed in the same or different classes? But to the agriculturist this is a matter of deep concern, since the grower of parsnips cannot but feel aggrieved if he has to pay more for the transport of his produce than the grower of carrots; and the grievance may even lead to his discontinuing altogether the growth of that commodity. The railway boards are generally advised by shrewd and capable men; but no man can know, or be expected to know, everything; and the technical knowledge necessary to a perfect and uniform classification is only likely to be available in the way we have suggested.

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TERMINAL CHARGES.

There is no question that has ever arisen between railway companies and their customers with reference to which there has been so much uncertainty, perplexity, litigation, and annoyance as that of terminal charges.

The history of terminal charges is a very long and a very unsatisfactory one. Originally the maximum mileage rate for distances beyond six miles was intended to cover all services of loading and unloading; but about the year 1841 a "short distance" clause began to be introduced into the several Acts, the object of which was to remunerate a company in cases where the traffic was carried so short a distance that the mere mileage rate would not cover such expenses.

Since then nearly every special Railway Act has contained a clause enabling the companies to make some additional charges for the special services referred to.

In some Acts of the session of 1860, the clauses limiting the maximum rates of charge are followed by a proviso authorising the railway company to demand "a further reasonable sum for collection and delivery of goods and other services." In one Act[1] the clause specifies "a reasonable sum for warehousing and wharfage." In other cases, companies are authorised to charge a reasonable sum for the use of stations and sidings, "in addition to their tolls and charges for loading, covering, and unloading goods."

The Devonshire Commission reported in 1867 that "if a railway company provide special means for facilitating loading, covering, and unloading, or allow goods to remain in their stations beyond a reasonable time, they would apparently, under their powers, and the intentions of Parliament, be enabled to charge for such services." It is added that railway companies would seem, in addition, to make charges for the expense of constructing and working

[1] Great Eastern Railway Act, 1862.

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sidings; but this is spoken of as if it were not an extra authorised by Parliament.

Under the Clearing-house regulations, there is a fixed terminal charge of 4s. per ton at each end for the country, and 8s. 6d. for London, which is credited to the companies who receive and deliver the traffic.

In the United States, there is no such thing as terminal railway charges as they are generally understood in Great Britain. But it is probable that there is something like their equivalent in the charges of the express companies which take the traffic from the station to its ultimate destination. So far as the railway companies themselves are concerned, they only begin to deal with the traffic after it is placed on their several systems, and they leave the collection and delivery to consigners and consignees. There is, however, so much competition for this work among the numerous express companies that the public can usually depend upon fairly reasonable charges being demanded. The rates quoted by the railways in the United States invariably include the use of trucks.

In Germany, there are recognised and fixed terminal charges, varying from 1s. 2d. to 2s. per ton, the charge within these limits increasing with the distance[1] for goods carried in lots of less than five tons. Such goods are, however, loaded and unloaded free of charge. In the case of larger loads, the charges for transport are lower, but the loading and unloading is done by the freighters, or, if these services are performed by the railways, a charge is made of 6d. per ton for loading, and the same for unloading. In Belgium there is generally a terminal charge of 10d. per ton; and in Holland this charge rises to about 1s. 4d. per ton.[2] In France the terminal charges usually vary from ½ franc to 1 franc per ton.

The Report of the Devonshire Commission contains

[1] Sir B. Samuelson's Report on the Railway Goods Tariffs of Germany Holland, and Belgium, 1855.

[2] *Ibid*

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many glaring examples of the character and variety of terminal charges. In many cases quoted the terminal charges are equal to the cost of haulage, and in some cases they even exceed that cost. According to a statement given by the North Staffordshire Railway Company, the rate from Stoke to Crewe appears to be 8s. 4d. per ton, and 8s. more is charged for cartage terminals. Again, the same company showed a charge of 6s. per ton from Stoke to Norton Bridge, and 5s. 6d. terminals in addition. Many similar examples might be quoted. And yet Mr. P. Morris, the manager of this company, admitted that the actual cost of terminal charges upon goods traffic generally did not exceed 2s. 3d. per ton.

It appears to be generally felt that the authority given under so many Acts of Parliament to levy terminal charges should not be withdrawn from the railway companies altogether. In Mr. Mundella's Bill of 1886, provision was made for the maintenance of those charges on a reasonable scale. But the question thereupon arises, "What are reasonable terminal charges, and on what basis should they rest?" It is difficult to frame rules that will equally apply to all the many complex cases that are likely to arise. Railway companies claim, for example, to impose higher terminal charges in London than in the provinces, because of the greater cost of the service. Some companies claim a right to make a profit out of terminal services. Again, it is argued on behalf of the railways that the expenses of collection and delivery vary so much in different places that no hard and fast rule can be laid down, although, as we have seen, such charges are fixed in Continental countries. It has also been contended that if uniform terminal charges were to be imposed, they would necessarily be so heavy as to be prejudicial in many cases where they would not otherwise be so. This, of course, must largely depend upon what terminal charges are meant to include. If, as is sometimes contended, they should include station accommodation generally there is

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little doubt that they would amount in the aggregate to a large sum.[1] One of the managers of a leading English railway gravely argued with the writer that the company was not bound to provide these station facilities, and that they might, if they pleased, deliver their merchandise traffic in an open field. As it is, they have undertaken the cartage of the traffic as well as its railway transport, and in many, if not all, cases they decline to allow traders to do their own cartage.[2]

The state of the law, so far as the matter has hitherto been tested, appears to be such as to establish nothing but uncertainty and confusion as regards terminal charges. In one important case,[3] Chief-Justice Cockburn held that the Company's Acts "give them no power to impose tolls or charges for collecting and delivering;" and he added that "it is palpably an abuse of their powers, if, under the name of a charge for carrying on their line, they impose, otherwise than with the consent of the parties concerned, a charge for a totally different thing." In a more recent case,[4] in which the railway company claimed to charge for station accommodation, for the use of sidings, and for "weighing, checking, clerkage, watching, and labelling," the Railway Commissioners came to one decision and the Queen's Bench Division to another, which was quite different—the Commissioners holding that the station and siding were appendages to the railway, and connected with the working of the line, so that the Company used them as carriers *on their line*, and not as carriers to and from the termini; while the Queen's Bench Division held the contrary. The view of the Commissioners has, however,

[1] Mr. Cawkwell informed the Devonshire Commission in 1866 that the North-Western had at that time expended over eight millions, or nearly 10 per cent. of their total capital outlay, on stations.

[2] Mr. Grierson informed the Duke of Devonshire's Commission that the Great Western Company allowed freighters to do their own cartage, but that the practice entailed great inconvenience.

[3] Baxendale *v.* the Great Western Railway Company.

[4] Hall *v.* Brighton Railway Company, 1886.

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many important decisions in its favour, one of the most recent being that the rate clause authorising terminal charges did not apply to the company as toll-takers, and that in loading and unloading, &c., they were really acting as carriers.[1]

The Select Committee on Railways (rates and fares) of 1882, after pointing out that some confusion had arisen from the use of the word "terminals," in reference alike to the cost of providing stations, sidings, warehouses, cranes, and other fixed plant, and to the cost of providing labour and appliances for loading, unloading, covering, collecting, and delivering traffic,—an outlay that varies in respect of different descriptions of traffic—suggested that it would be well if these charges could be distinctly classified under the two headings of "Station Terminals" and "Handling Terminals." Except in the two cases of the Lancaster and Carlisle Act of 1844, and the North Staffordshire Act of 1880, the Committee did not find that the railway companies had, in any of their Acts, been authorised to make a charge for the "use of stations." They were, however, of opinion that the right of railway companies to charge for "station terminals" "should be recognised by Parliament, so as to provide by a general Act that the sums which they claimed a right to demand for terminals of any kind at each station shall be clearly entered in the rate-book, or otherwise publicly notified at such station," in order that the public should be in a position to challenge before the Railway Commissioners the reasonableness of the sum so charged.

As the case stands at present, the railway companies are accustomed, under the cover of their authority to exact terminal charges, to transgress the limits of their maximum rates. But of the total rate made for transportation, the companies seldom or never separate the carrying from the terminal charge. They have shown very little disposi-

[1] **Aberdeen Commercial Company v. Great North of Scotland Railway Company.**

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tion to carry out the recommendations of the Devonshire Commission—namely, that terminal charges should be defined to be charges for all services rendered by the railway company beyond conveyance from station to station; that they should be based upon the expenses incurred in the receipt and delivery of the goods on and from the line; that they should be required to notify publicly at each station the charge they make for such terminal services; and that, at the request of a freighter, they should be required to separate these charges from the mileage rate in their account with him.

The character and extent of the terminal charges claimed by railway companies may be judged from the particulars given in the case of Kempson *v.* Great Western Railway Company (1884) in which the company claimed to be entitled to charge for—

(1.) Provision of station accommodation.

(2.) Shunting and placing wagons into position for loading and haulage to the place where they are picked up by the train, including use of junctions and expenses of working the same.

(3.) Advising the applicants of the receipt by the company of each consignment to the applicants' order, and asking for their instructions, with incidental clerkage, stationery, and stamps.

(4.) Weighing, checking, clerkage, watching, and labelling.

(5.) Provision of station accommodation at destination of traffic.

(6.) Shunting and placing wagons in position for unloading at such destination, with use of junctions and expenses of working same.

(7.) The applicants always requiring the goods to be sent to destination to their order, advising them at their request of their arrival at destination, with clerkage, stationery, and stamps.

(8.) Clerkage, checking, and watching at destination.

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The Railway Company also claimed that, either as a separate item, or by a proper increase of each of the other items, they were entitled to charge a fair amount as representing the profit in respect of the business carried by them, and the risk therein incurred.

It is impossible to allocate precisely to each of above heads of claim, all of which are incident to the duty or business of carriers, an exact amount, and the company claimed to be entitled, if they should deem it necessary so to do, to apply the rate of charge made under one of the above heads, or of the heads mentioned in the application, to any other.[1]

Whatever course may be taken by Parliament in reference to the vexed question of terminals, it appears to be necessary to provide for a maximum terminal rate. This has been attempted more than once already, but without success. In 1861 the question was raised before Lord Redesdale and a Committee of the House of Lords, and the chairman of Committees named a terminal which the railway companies, with one or two exceptions, were willing to accept as a settlement; but the coal trade objected to the proposal as affecting minerals, and their opposition led to the matter being shelved. It was then proposed to have two terminal rates, one for mineral, and another for general merchandise traffic; and these were further to be varied as between the metropolis and the provinces.

The cost of the terminal services, whatever it may be ought not greatly to vary as between one railway and another for the same description of merchandise. As regards mineral traffic, it may be ascertained and stated with absolute precision. As regards merchandise, it is likely, within narrow limits, to vary according to the character of the traffic, &c. But at present no two companies appear to charge precisely the same sum for precisely the same services; and if terminals are to be recog-

[1] *The Journal of the Railway and Canal Traders*, December 1884.

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nised at all, this should, as far as possible, be made a compulsory requirement.

Railroad "Pooling" Combinations.

In the United States, there is a system commonly known as "pooling," or dividing the traffic receipts, which has for a number of years past been adopted by a large number of the leading railways.

This system has no exact counterpart in other countries. In the United Kingdom, much the same results are arrived at by an arrangement as to the rates and fares to be charged by different companies running to the same points from the same termini. Thus, for example, the distance between London and Birmingham is 113 miles by the North-Western, and 129½ miles by the Great Western, and yet both charge the same fares. Again, between London and Leeds by the Great Northern is 186 miles, and by the North-Western 226 miles, but the fares are identical on both lines. Many similar cases could be quoted.

On the Continent of Europe neither system obtains to any material extent, since it seldom happens that there is more than one route to travel by. In France, for example, if it is proposed to travel from Paris to Marseilles, Bordeaux, or any other large centre, there is only one route available. In Germany it is much the same. To distant points there are, it is true, often a plurality of routes at command, as, for example, the two lines to Vienna, *vid* Munich and Dresden, respectively; but in almost every case, the rule adopted is to charge according to distance.

In the United States, where "pooling" has assumed the dimensions of a national problem of the gravest importance, there were in 1880 only two railways engaged in trans-Continental transportation—the Union Pacific and the Central Pacific. At the present time, however, there are eleven different companies competing sharply for this traffic. These companies for a time engaged in a war of rates. Receipts from traffic were thereby greatly reduced.

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Many railway companies became seriously embarrassed. Others were driven into bankruptcy. At last it was determined to put in force George Stephenson's apophthegm that "where combination is possible competition is impossible;" and the different companies made arrangements to protect themselves against themselves.

It is claimed by their authors and advocates that pooling agreements establish over their constituent members a sort of government having jurisdiction—

(1.) As to the apportionment of the traffic.

(2.) As to the establishment of the rates which shall be charged for transport of goods of various classes, and the maintenance of such rates.

(3.) As to rendering such returns, either to each other or to a joint agent, as may be required to enable the managers of each line to know what amount of traffic competing lines are carrying.

(4.) As to the determination of the route which the traffic shall take from the point of receipt to the point of destination.

(5.) As to the division or pro-rating of rates over the different roads on which the traffic is carried in each case of joint service.

(6.) As to the establishment and maintenance of an uniform classification of rates.

Pooling agreements are usually founded upon the relative amount of traffic which each company may have been able to obtain during a period of competition, and upon a careful estimate of the ability of each company to secure the traffic. But as the relation in this regard of the constituent lines to each other is constantly changing, as the result of the development of local or through traffic, the construction of new roads, the formation of new combinations and agreements, and many other causes, there is a constant liability to revolt and disruption.

It seems, nevertheless, to be generally admitted that, in the United States, "pools" have not been without a bene-

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ficial influence. They have prevented unjust discriminations, through special secret rates, to favoured freighters; they have prevented, similarly, unjust discriminations against towns and cities, and against particular States or sections of the country; they have tended to put an end to constantly fluctuating rates; they have prevented the absorption of the weaker lines by the stronger, and have thus conserved the elements of competition; they have tended to prevent the bankruptcy of the great railroad corporations, and the consequent shocks to the financial interests of the country. Moreover, they have not hindered, but rather assisted to promote, the extension of transportation facilities, the reduction of rates, and the development of traffic.

Upon the general question of the expediency of pooling agreements, the author's friend, Mr. W. P. Shinn, remarks:[1]—

"The question of 'pooling' has been much discussed, and it has been decided by an Ohio court to be illegal.

"Unrestricted competition between carriers is not an unquestionable blessing. It must be conceded that, as a rule, carriers must charge sufficient to pay the cost of operation and a reasonable interest on the investment. Anything furnished at less than cost is liable to be unsatisfactory. If rates are below cost at one season, they must be unreasonably high at another, in order to keep up the average.

"Producers and consumers are more interested in having rates for transportation *uniform, steady, and reliable* than in having them *low*.

"Pooling is the best means so far found for making and keeping rates uniform, steady, and reasonable; and if they are so the public is not injured.

"If, therefore, pooling be not clearly legal, it should be put under the sanction of law by a statutory provision to that effect."

[1] The Relations of Railways to the State, p. 11.

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Discriminations and Unequal Rates.

There has always been a feud between the railways and a section or sections of the community whom they serve in respect of real or supposed inequality of treatment, as between different districts and different individuals. The feud is as unsettled and as keen to-day as it was in the infancy of the system. It is found to prevail wherever railways have been established. It has everywhere presented similar, if not quite the same, phases, and it has in the great majority of cases been found incapable of solution or settlement.

In the very nature of the case, there must be jealousy and disagreements on such a subject. Railways are like butchers or bakers in their methods and laws. When a butcher or a baker finds himself a monopolist, he generally keeps up his price. If he is exposed to limited competitions, he makes his price a matter of arrangement. If the competition is so keen that he is threatened with total loss of an important part of the trade he is aiming and anxious to secure, he will offer very special inducements, in order to avoid the threatened loss.

The railway companies say, in effect, that if the tradesman sells practically without profit, or at mere cost price, in order to secure the threatened part of his trade, his regular customers, who are paying the ordinary trade price, and who would pay that price in any case, are no worse off. But, on the other hand, it is argued that railways differ from ordinary tradesmen in being, for the most part, great monopolies—that if a tradesman discriminates between his customers, those against whom the discrimination is exercised have generally a remedy in going elsewhere, or setting up an opposition shop, whereas with a railway no such resource is open. This, again, is true as regards the great majority of cases. The total

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number of stations in the United Kingdom may now possibly be over 5000. Of that number more than one-half are absolutely without competition, whether by sea or land, by road or by canal. The railway companies make no secret of the fact that in the entire absence of competition they are accustomed to charge higher rates than they usually do when they have competition to meet. Their justification is, of course, that if they did not quote lower competitive rates they would lose the traffic entirely. They deny that the acquisition of such traffic by such differentiation is an injustice to any one. The ordinary trader would not, they say, secure any lower rates even if these special rates were not quoted. Nay, they go still further, and maintain that the fact of their being able thus to secure otherwise doubtful traffic by quoting specially low rates is a positive advantage to the regular traders, whose rates are normal, because the greater the volume of traffic over which the working cost is spread, the larger will be the amount of net revenue available for distribution—for creating additional facilities, for generally lowering rates, and for dividend purposes.

The perils that beset the unprivileged trader by the arbitrary discrimination of rates were recognised and provided for at an early period in railway history.

The Railway Clauses Consolidation Act gives a railway company power to vary its rates within its Parliamentary maximum, "provided that all such tolls be at all times charged equally to all persons, and after the same rate, whether per ton, per mile, or otherwise," and it is further provided that "no reduction or advance in any such tolls shall be made, either directly or indirectly, in favour of or against any particular company or person."

The same principle is laid down by the Traffic Act, which enacts that "no company shall make or give any undue or unreasonable preference or advantage in favour of any particular person or company or particular description of traffic."

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It is not pretended that these enactments have been scrupulously observed. On the contrary, they are broken every day, by nearly every railway company in the country. Their strict observance has, in effect, been declared to be impossible, even by Commissions and Committees appointed to inquire into their operation.[1]

What, then, are the remedies at the command of traders in cases of discrimination? The first and most obvious is the limitations imposed upon the railway companies by their maximum rates. If these are exceeded, the companies may be proceeded against for penalties. The next is the right to claim damages for undue preferences. In England this is one of the questions on which the Railway Commission was appointed specially to adjudicate. If a railway should be proved to allow to A a much lower rate than it does to B from the same points to the same points, this would clearly be at once a breach of the general acts under which the powers of the company were granted, and an injustice tending to the serious detriment of B. In such a case the remedy is simple and clear, but unfortunately it is by no means either swift or sure, since the railway company may harass the trader by appeals from the Railway Commission to superior tribunals. In Mr. Mundella's Bill of 1886, express provision was made for an appeal from the order or decision of the Commission. This provision was strongly opposed, and it was urged that if an appeal were to be allowed at all, it should only be *by leave of the Commissioners*, which seems a reasonable condition. It is manifestly of the first importance that whatever remedy or means of redress Parliament may provide, should be at once inexpensive, summary, and certain.

[1] The Devonshire Commission considered "that it would not be expedient, even if it were practicable, to adopt any legislation which would abolish the freedom railway companies enjoy, of charging what sum they deem expedient within their maximum rates." The Select Committee of 1881 came to almost the same conclusion, but deprecated illegal charges and undue preferences.

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We have already observed that discriminations in railway charges are not by any means peculiar to England. Sixteen years ago the same problem exercised the minds of the farmers of the Western States of America, and brought about the well-known Granger movement, the tendency of which was to transfer the power of making rates from the railway companies to the general community whom they served. In Illinois, Iowa, and Minnesota, laws were passed prescribing that all railway rates should be reasonable and without discrimination. In Wisconsin the Legislature went still farther, and established systems of rates that failed to meet the cost of working. The maintenance of these regulations was ultimately upheld by the Supreme Court of the United States, and the American people have ever since set their faces sternly against railway discriminations. Many bills have been introduced in order to render them illegal. One of the most recent (the Reagan Bill) was designed to get rid of both local and personal discrimination. But this is thought by the more moderate section of the people to be going too far, and especially if, as is probable, it should prohibit lower through rates than local ones.[1] The matter is still unsettled, and apparently likely to remain so.

It has been much the same on the Continent of Europe. In March last the French Chamber of Deputies held fourteen different sittings on this very question. Some complained that the incidence of goods rates is unequal and unfair; others that they are too high; and others, again, that they press unfairly on local centres. The opportunity was therefore taken, on the occasion of a revision of the tariffs of some of the leading companies, to raise the whole question, alike in the abstract and in the concrete. It was especially insisted that the import rates, which allowed

[1] Mr. Hadley points out, in his excellent work on transportation, that if the railways were thus compelled to level up their through rates, grain would be sent from the West *vid* Canada, where there is no similar restriction.

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foreign produce to compete in French markets with local or home produce, required revision. The specially low rates between Marseilles and Paris, Belfort, &c., were severely condemned, and the reply of the companies was that correspondingly low rates were charged by canal. Again, although the French companies are nominally bound to levy their rates in proportion to the distance, it was argued that the principle was departed from both by having breaks called *paliers*, and by the so-called *tarif d'application*, under which the distances are given in two separate columns, one of them having the real distance and the other a reduced distance upon which the rate was calculated. Many specific examples of the evil of discrimination were quoted. One of the most important was that of the transport of corn, which is carried from Dunkirk to Paris for 11 francs 85 cents, although the charge made for inland transport over the same distance—from Chateauroux to Paris—was 4½ francs more. In this case it was contended that the inland rate should be lowered, to meet the discrimination, because if the Dunkirk-Paris charge were raised the grain would come equally cheap by river and canal. After considering these and many other specific cases, the Chamber decided to carry on active negotiations with the various railway companies with the view to tariff improvement, and strengthened the present Parliamentary Commission, which is required to initiate legislative measures that are calculated to maintain the rights and the action of the State in matters of railway control. Such a resolution appears designed to establish and perpetuate a state of antagonism between the railways and the State; but it is also likely to lead to improvements in the existing tariffs. This has indeed already come to pass, for the Eastern Railway system, which had recently seventy-two special tariffs, has now only twenty-eight, divided into twelve groups or classes, with rates diminishing in regular proportion according to the distance.

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So far as the railways of Great Britain are concerned, they are perhaps more liable to the sin of discrimination than those of any other European country. Our import trade is much larger and more varied. We have a multitude of industrial and commercial interests constantly pressing for consideration. The number of rates is consequently legion. The North-Western Company alone are said to have twenty millions of them. The avowed principle of railway traffic managers—to impose on the traffic such rates as it can bear—is a principle of discrimination. There is no pretence of charging rates according to the cost of the service. The railways have got rid of this good old standard of charges, and have adopted instead the basis of charging all that they can get. That principle does not look well on the face of it, but it may be the only one that is practically workable. Upon the point we offer no opinion. A provision in Mr. Mundella's Bill of 1886 was designed to provide against undue preference, and threw the burden of proof on the railway company; but since the Commission required to consider whether the preferential rate was necessary for the purpose of securing the traffic, the chances are that no railway company would find it difficult to prove that it was. This is not the way to get rid of discriminations, if that is to be the object aimed at. But if we are to be quite candid in this matter, we have never yet seen a clause draughted that would absolutely bring about that result.

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APPENDIX.

CHRONOLOGY OF RAILWAY EVENTS AND LEGISLATION IN THE UNITED KINGDOM.[1]

1660. Tramways of wood and iron began to be employed in the coal-mines about Newcastle-on-Tyne, in order to facilitate the transport of wagons to the river.

1692. Savory's patent for steam-engine.

1705. Newcomen & Crawley's patent for steam-engine. This was the first engine in which there was a connecting-link between pumps and engines; it contained also a cylinder open at the upper end, fitted with a piston, the upward movement of which was induced by the pressure of steam underneath, the downward movement being caused by the pressure of the air.

1716. Thin plates of malleable iron began to be nailed on the upper surfaces of wooden tramroads at north-country colleries.

1759. Dr. Robison proposed the adoption of steam locomotion in Scotland.

1767. Cast-iron rails began to be substituted for wooden bars.

1768. Watt's first steam-engine constructed.

1769. Watt's patent.

1772. Oliver Evans, in United States, suggested the use of steam for locomotion.

[1] This does not profess to be a record of any except the earlier and more important events in railway history. Only the more significant legislative enactments, &c., have been specifically named.

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1774. Steamboat tried on the Seine.
1777. Curr of Sheffield introduced rails in collieries instead of sledges.
1782. Murdoch's steam-engine constructed.
„ Steamboat tried on the Soane.
1783. Fitch's steamboat to America.
1784. Watt patented application of his engine to locomotion.
1787. Ramsay's steamboat experiment on the Potomac.
1788. Steamboat experiments in England and in Scotland.
1793. Stone blocks used in place of wooden supports or sleepers on railways.
1794. Cast-iron rails laid on Walbottle Colliery Railway.
1801. Earliest railway or tramway Act passed for the construction of a line from Wandsworth to Croydon, by the Surrey Iron Railway Company, with a capital of £35,000.
„ The first edge-iron railway at Lord Penrhyn's collieries.
„ Symington's steamboat experiments.
1802. Trevithick and Vivian's high-pressure engine—the first designed to work on railways, &c.
„ Symington's two steamboats tried on the Forth and Clyde Canal.
„ Carmarthen wire railway constructed, at a cost of £35,000. It was eleven miles in length.
1804. Trevithick constructed a steam locomotive for running carriages on the Merthyr Railway. This is claimed as the first railway locomotive. The cylinder was placed horizontally, and the heads of the piston-rod and connecting-rod were divided, or forked, leaving room for the motion of the extremity of the crank, and giving motion to it, fixed on an axle-tree.
„ Oystermouth Railway, six miles long, constructed at a cost of £12,000.
„ Fulton's first American patent for steam navigation.
1807. Fulton's American steamboat tried.
1808. Kilmarnock Railway, ten miles long, constructed at a cost of £40,000.
1809. Trevithick's experiments designed for the construction of a tunnel underneath the Thames.

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1809. Forest of Dean Railway, seven and a half miles long, constructed to convey minerals to the Severn.

„ Severn and Wye Railway constructed, twenty-six miles long, at a cost of £110,000.

1811. Blenkinsopp's patent for locomotive engine.

1812. Bell's steamboat, the "Comet," commenced to ply between Glasgow and Helensburgh, at the rate of five miles per hour.

„ Grosmont Railway, between Abergavenny and Hereford, constructed at a cost of £13,000.

1813. Mr. Blackett made a steam locomotive from Trevithick's model.

„ Chapman's locomotive, worked by an endless chain, tried on Heaton Colliery Railway.

„ Hedley's engine tried on Wylam Colliery Railway.

„ Trial of locomotive engine on Cox Lodge Colliery Railway.

1814. Mr. George Stephenson's first locomotive, "My Lord," was tried on the Killingworth Colliery Tramway. This engine was made upon Blackett's model. It had two cylinders, each 8 inches diameter and 2-feet stroke, The boiler was cylindrical, 8 feet long, 34 inches diameter. The tube was 20 inches diameter, and passed through the boiler. The cylinders worked two pairs of wheels by cranks placed at right angles.

„ Railway constructed to connect Abergavenny Canal with Usk Bridge, Monmouth.

1815. Mr. George Stephenson's patent for steam locomotives.

„ Malleable iron rails began to take the place of rails of cast iron.

„ Gloucester and Cheltenham Railway, nine miles long, constructed.

1817. Mansfield and Pinxton Railway constructed, at a cost of £32,800.

1818. New locomotives by Stephenson.

„ Kingston Railway constructed, fourteen miles long, at a cost of £23,000.

1819. Plymouth and Dartmoor Railway, thirty miles long, constructed at a cost of £35,000.

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1821. Act passed authorising the construction of a railway from collieries near Darlington to the port of Stockton-on-Tees, to be worked by horse-power only.

„ Stratford and Moreton Railway, length eighteen miles, cost £50,000.

„ Griffith's patent for steam locomotives on common roads.

1822. Mr. D. Gordon's patent for steam locomotives.

„ Act of Parliament for carrying passengers on the Stockton and Darlington Railway.

„ Liverpool and Manchester Railway projected.

1823. Amended Act passed authorising the Stockton and Darlington Railway Company to work their line by means of locomotive engines, and to employ them for the haulage of passengers as well as merchandise.

1824. Up to this time twenty-four separate Acts had been passed authorising the construction of railways.

„ Redruth and Chasewater Railway, Cornwall, fourteen miles long, cost £22,500.

„ Prospectus of Liverpool and Manchester Railway issued.

„ Monkland and Kirkintilloch Railway, ten miles long, constructed at cost of £25,000.

1825. Opening of the Stockton and Darlington Railway.

„ In consequence of the delays and difficulties experienced by the Manchester manufacturers in obtaining their supplies of cotton from Liverpool by water communication, owing to drought in summer and frost in winter, an application was made to Parliament to sanction the Liverpool and Manchester Railway. It was mainly intended for the conveyance of merchandise, but the promoters sought powers in their Bill to convey both goods and passengers by locomotive power.

„ First locomotive constructed by George Stephenson for Stockton and Darlington Railway. This locomotive is still extant; it is placed on a pedestal at the Darlington North Road Station.

„ Rhymney Railway, South Wales, constructed at cost of £47,100.

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1825. West Lothian Railway from Ryall to Shott, twenty-three miles, cost £40,700.

1826. Bill introduced into Parliament for the construction of a railway between Liverpool and Birmingham, but rejected.

„ Act of Parliament obtained for the Liverpool and Manchester Railway.

„ Cromford and High Peak Railway, thirty-four miles long, cost £164,000.

„ Duffryn, Llynvi, and Portcawl Railway, Glamorganshire, seventeen miles long, cost £60,000.

1829. Great trial of locomotives at Manchester (October), as the result of which Stephenson obtained a prize of £500 for the success of his "Rocket" engine. This engine is now in the Patent Museum, South Kensington.

„ Acts passed for lines from Newton to Warrington and from Newcastle to Carlisle.

1830. Liverpool and Manchester Railway opened.

„ Railway construction commenced in the United States.[1]

1831. Forty-four additional railway Acts had been passed by Parliament to the end of this session.

1832. Bill for making the London and Birmingham line thrown out in the House of Lords.

1833. Act passed for the construction of a railway with locomotive power from London to Birmingham.

1835. The number of Acts passed for new railways from 1832 to the end of this year averaged eleven per annum; but twenty-nine railway Acts were passed in the year 1836.

„ Select Committee recommended that every opposed Bill should be referred to a Committee of five, assisted by a Select Committee.

1836. Royal Commission appointed for the purpose of con-

[1] The following lines in the United States were either completed or commenced in 1830:—

The Baltimore and Ohio	15 miles.
„ Schuylkill Valley	11 „
„ Mill Creek and Mine Hill	4 „
„ South Carolina	10 „

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sidering a general system of railways for Ireland, and the best mode of directing the development of this new means of intercourse into the channels where the greatest advantage might be obtained by the smallest outlay, with a view to developing the resources of the country.

1837. House of Commons appointed a Select Committee to which all petitions for private bills were referred. This Committee was of a strictly judicial character, and consisted of forty-two members, who were assisted by four sub-committees, under four separate chairmen.

„ Select Committee appointed by Parliament to report what measures it would be just and expedient to adopt for the purpose of securing to the public the benefit of conveyance of mails by railroad.

1838. In this year there were 490 miles of public railway open in England and Wales, and about 50 miles in Scotland.

„ Select Committee reported, recommending the general provisions, which have been inserted in the Act 1 & 2 Vict. cap. 98, and that the Post-Office should have power to run its own engines on a railway, when a train conveys passengers, without paying tolls. The recommendation was not adopted.

1840. Another Select Committee was appointed by the House of Commons upon the railway system. It came to the conclusion that the right secured to the public by the railway Acts, of running their engines and carriages on the railways, was practically a dead letter; (1) because no provision had been made for ensuring to independent trains and engines access to stations and watering places along the lines; (2) because the rates for toll limited by the Act were almost always so high as to make it difficult for independent persons to work at a profit; (3) because the necessity of placing the running of all trains under the complete control of one head interposed numerous difficulties in the way of independent traders.

1841. Act 3 & 4 Vict. cap. 97 passed, by which it was provided

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that no new railway for the conveyance of goods or passengers should be opened without previous notice to the Board of Trade, and the Board was empowered to appoint officers to inspect all new railways. The Board was also empowered to require, under a penalty, that every railway company should deliver to them returns, in whatever form they might prescribe, of the traffic in passengers and goods, as well as of accidents attended with personal injury, and a table of tolls and rates from time to time levied on passengers and goods. All bye-laws already made by companies were to be certified to the Board, and no new ones were to be made without its sanction. The Board was also constituted the guardian of the public interests, being empowered, at its discretion, to certify to the law officers of the Crown any infraction of the law, and the law officers of the Crown were thereupon required to take the requisite legal proceedings.

1842. Act 5 & 6 Vict. cap. 55, passed, altering the powers of the Board of Trade. The notice to be given before opening a railway was confined to passenger lines, and the power of requiring returns of accidents was extended to all cases of accident, whether or not attended with personal injury. Every railway company was also required to convey troops on railways at prices to be settled between the railway companies and the Secretary at War. The Act defined "that no railway shall be considered a passenger railway if two-thirds or more of the gross annual revenue of such railway shall be derived from the carriage thereon of coals, ironstone, or other metals or minerals."

1843. Length of railway authorised by Parliament to this date was 2390 miles, of which 2036 had been opened for traffic. Authorised capital, £82,848,000; subscribed capital, £66,000,000.

1844. Another Select Committee appointed to inquire into the subject of railway communication.

„ Act passed (7 & 8 Vict. cap. 85), by which it was provided that if the clear annual divisible profits should amount

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to 10 per cent. on the paid-up capital of any railway authorised in that or any subsequent session, at the end of twenty-one years from the passing of the Act sanctioning the line, the Lords of the Treasury might revise the tolls, fares, and charges, so as to reduce the dividend to 10 per cent.; but such revision was to be accompanied by a guarantee on the part of the Crown that the revised rates should produce a dividend to the company of 10 per cent. for a further period of twenty-one years. The Treasury was also empowered to purchase the railways sanctioned in that or any future session, upon payment of twenty-five years' purchase of the average annual divisible profits for three years previously, if not under 10 per cent. per annum.

1844. House of Commons resolved that the following clause should be inserted in all railway Bills passing through Parliament, viz.:—

"And be it further enacted that nothing herein contained shall be deemed or construed to exempt the railway by this or the said recited Acts authorised to be made from the provisions of any general Act relating to such Bills which may pass during the present session of Parliament, or of any general Act relating to railways which may pass during the present or any future session of Parliament."

1845. Parliament, as recommended by the Select Committee, passed three Acts containing the clauses which could be made applicable to companies in general, and which it had been usual to insert in the private Acts, and adding such other general provisions as Parliament deemed it desirable to enforce on railway companies, viz.:—

(1.) The 8 Vic. cap. 16. The Companies' Clauses Act. To regulate the manner in which the company's capital should be raised, and further capital borrowed, the rights of the shareholders, the powers and duties of directors, the declaration and payment of dividends, the keeping and auditing of accounts, and generally the mode in which the company's affairs should be

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conducted, as regards the shareholders and creditors of the company.

(2.) The 8 Vic. cap. 18. The Lands Clauses Act. To regulate the acquisition of land for the undertaking, either compulsorily or by arrangement, the payment of compensation, the security of title to the land, and the sale of superfluous land.

(3.) The 8 Vic. cap. 20. The Railway Clauses Act. To regulate the construction of railways, the temporary use of lands for that purpose, and the acquisition of additional lands for stations, the crossing of roads, the construction of bridges, the screens for roads, the works for accommodation of landowners, and the acquisition and working of mines under a railway.

By section 76, the owners of lands adjoining the railway are empowered to make collateral branch lines to communicate with the railway, subject to the following restrictions :—

No branch railway shall run parallel to the railway. The company shall not be bound to make an opening at any place which they may have set apart for any specific purpose, with which such communication would interfere, nor upon any inclined plane or bridge, nor in any tunnel. The persons making the branch are to be subject to such bye-laws as the company may make, and to maintain the junction properly, under the direction of the company's engineer.

1846. Select Committee appointed to consider the principle of amalgamation, as applied to the railway and canal Bills then under the consideration of Parliament.

,, Royal Commission appointed in the previous year to inquire whether a uniform gauge should not be prescribed, made a recommendation in favour of the narrow gauge.

,, Gauge Act passed, defining the districts to which the broad gauge was to be limited, and rendering it compulsory on all railway companies in other parts of Great Britain to adhere to the narrow gauge of 4 ft. 8½ in.

,, Royal Commission appointed to inquire into and report

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upon certain schemes for railways proposed to be constructed in and around the metropolis.

1846. Sub-committees discontinued in favour of examiners of standing orders.

„ Committee of the House of Lords appointed to consider whether a uniform system of management could be enforced on railways; how the expense attendant on obtaining Acts of Parliament could be diminished; and whether legislative measures could be framed to protect individuals from the injury they sustained from railways passing through their property, so as to relieve them from being subjected to the expense of opposing Bills in Parliament.

„ Committee of the House of Commons appointed to consider whether conditions could not be embodied in railway Acts, better fitted than those already inserted, to promote the interests of the public.

[These Committees concurred in recommending the appointment of a department of the Government which should make preliminary investigations into all railway schemes, and be charged with a general control and supervision of railways.]

„ An Act passed establishing a Board of Commissioners of Railways, to whom the powers possessed by the Board of Trade were transferred.

1847. Bill introduced into Parliament for the regulation of railways, and for defining the powers which should be vested in the Commissioners. It was withdrawn on the second reading.

„ The number of Acts for new lines and extensions in this and the previous three years were :—

Years.	Acts.	Miles proposed to be Constructed.	Capital proposed to be Raised.
1844 . .	57	805	£20,500,000
1845 . .	120	2,700	59,479,000
1846 . .	270	4,538	132,617,000
1847 . .	190	1,354	39,460,000
Totals .	637	9,397	£252,056,000

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1847. Act passed for extending the time for making certain railways.

Railway clearing-house established by voluntary association of a few of the narrow gauge companies.

1848. Standing order passed by the House of Lords abolishing the practice of leaving questions arising out of compliance with the standing orders to be dealt with by the then Committee, and appointing a General Committee consisting of forty peers, to decide all such questions.

1849. A Committee of the House of Lords appointed to consider "whether the railway Acts do not require amendment, with the view of providing for a more effectual audit of accounts, to guard against the application of the funds of such companies to purposes for which they were not subscribed, under the authority of the Legislature."

The Committee recommended that an uniform regulated form of account should be prescribed for all railway companies, and that this form should embrace the following particulars:—

(1.) A full statement of all the Parliamentary powers granted for raising money, and showing the undertakings to which they were applicable; the manner in which the money had been raised under these Parliamentary powers, showing the nature of securities issued under each Act, with the conditions and rate of interest applicable to each, and the amount of money obtained and arrears, and the balance of Parliamentary powers unexhausted.

(2.) A capital account explaining how the money shown as having been raised under the parliamentary account had been disbursed.

(3.) An account of the ordinary income and expenditure of the railway company.

Bills embodying some of these provisions were introduced into Parliament in subsequent sessions, but they did not become law.

1850. Incorporation of the railway-clearing house. The Act enacted that any railway company might join the asso-

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ciation or retire from it at a month's notice, and that any company might be compelled to retire at the request of two-thirds of the associated companies.

[Each company connected with the clearing-house is represented by a delegate; the delegates constitute a Committee for conducting the business of the association, with a chairman, secretary, and treasurer. The Committee are empowered to adjust all accounts between the several companies, and decisions by a plurality of the votes of the delegates respecting any matters of account between the companies are final and conclusive. Any balance found due from a company is a debt due to the Committee, for the recovery of which a special remedy is conferred by the Act. The Committee is required to keep entries of all its proceedings, which are to be received in evidence in any suit against a company which is a member of the association.]

1853. Parliament sanctioned the first Metropolitan Railway Act, for a line to run under the new road from Edgeware Road to King's Cross.

„ Select Committee appointed to consider the principle of amalgamation, as applied to railway or railway and canal Bills about to be brought under the consideration of Parliament, and to consider the principles which ought to guide the House in railway legislation.

1854. Appointment of a General Committee from which the chairmen of the several Committees on Railway Bills were selected.

„ The Railway and Canal Traffic Act passed, which enunciated, more fully than had been done before, the principle that every railway company should afford all reasonable facilities for the receiving and forwarding and delivery of traffic, upon and from the different railways, and that no company should make or give any undue or unreasonable preference or advantage to, or in favour of, any particular person or company, or any particular description of traffic in any respect whatsoever, and that every railway company having

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or working railways, which form part of a continuous line of railway or railway communication, or which have the terminus or station of the one near the terminus or station of the other, should afford all due and reasonable facilities for receiving and forwarding all the traffic arriving by one of such railways by the other without any unreasonable delay, and without any preference or advantage, or prejudice or disadvantage, and so that no obstruction should be offered to the public desirous of using such railways (21 & 22 Vic. cap. 75).

1858. Act passed prohibiting all canal companies, owning railways, from abandoning their undertakings, without a special Act for the purpose.

1859. Act passed empowering railway companies to submit to arbitration any existing or future differences.

1861. Railway companies applied for a clause to be inserted after the maximum rate clause in their several Bills, authorising terminal charges.

1863. Committee of the House of Lords to examine the question of metropolitan railway communications.

1864. Joint Committee of both Houses of Parliament appointed to consider metropolitan railway schemes.

1865. Railway Companies' Powers Act passed, enabling railway companies to enter into agreements in the following matters:—

The maintenance and management of the railways of the companies, respectively, or of any one or more of them, or of any part thereof, respectively. The use and working of the railways or railway, or of any part thereof, and the conveyance of traffic thereon. The fixing, collecting, and apportionment of the tolls, rates, charges, receipts, and revenues levied, taken, or arising in respect of traffic. The joint ownership, maintenance, management, and use of a station or other work, or the separate ownership, maintenance, management, and use of several parts of a station or other work. Public notice of the intended agreements, is to be given, the Board of Trade having power to inquire into the merits of objections; but in case any railway or canal com-

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pany objects to the proposed agreement, and desires to be heard by counsel, the Board of Trade is not to proceed with the agreement, but to leave the parties to apply to Parliament.

1865. Railway Construction Facilities Act (27 & 28 Vict. cap. 120 and 121) passed, under which power may be obtained from the Board of Trade to construct a railway when the whole of the proprietors, whose land is required for the purpose, consent to part with it for the undertaking, and when no railway or canal company objects to the project in the manner prescribed by the Act. The promoters of the undertaking, if more than seven, are to be incorporated by the Board of Trade, with power to raise capital by shares, or by borrowing to the extent prescribed in the certificate of incorporation. The company is to be entitled to take tolls and charges within the maximum prescribed in the schedule to the Act, unless varied by the certificate of the Board of Trade.

[This schedule was the first attempt made by Parliament to reduce the rate of tolls or charges to be made by railway companies to a general system.]

1865. Bill introduced by the President of the Board of Trade for the enactment of certain general clauses applicable to railways. This Bill was reintroduced in the following year, but did not become law.

„ Royal Commission appointed to inquire into railway charges, &c.

1866. Railway Securities Act passed, binding every railway company to register half-yearly, at the office of the Registrar of Joint-Stock Companies, an account of its share and loan capital, &c.

1867. The Duke of Devonshire's Commission reported on the subject of railway charges, &c.

„ Act to amend the law relating to railway companies (30 & 31 Vict. cap. 127) passed. This Act protects rolling stock from creditors, and contains provisions relating to loan and share capital, the abandonment of lines, the purchase of land, &c.

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1868. Regulation of Railways Act passed (31 & 32 Vict. cap. 119). This Act prescribed the forms of accounts to be furnished by railway companies, provided for the examination of affairs by inspectors and auditors, for the issue of preferred and deferred ordinary stock, defined the liability of a company during sea transit, provided for the posting of fares in stations, for securing equality of treatment where a railway company works sea vessels, compelled a railway company to furnish particulars of charges for goods, and the providing of smoking compartments for all classes, required the establishment of communication between passengers and guards, made provision for compensation for accidents, and for the appointment of an arbitrator by the Board of Trade, &c. &c.

1873. Act passed to make better provision for carrying into effect the Railway and Canal Traffic Act, 1854 (36 & 37 Vict. cap. 48). This is one of the most important Acts affecting the relations of railway companies and the public.

Under section 4 a tribunal is established, consisting of three Commissioners, with jurisdiction to entertain any complaints of anything done, or of any omission made in violation or contravention of section 2 of the Railway and Canal Traffic Act, 1854,[1] and of section 16 of the Regulation of Railways Act, 1868,[2] or of any enactment amending or applying to those enactments.

The principal provisions of this Act are those that define the duties and powers of the Railway Commissioners, who, under section 15, are empowered to fix terminal charges; under section 16, have control over agreements between railway and canal companies; and under section 25, have power to decide on all questions of law or of fact.

[1] This section defines the duties of railway companies in making arrangements for receiving and forwarding traffic, without partiality and without unreasonable delay.

[2] This section provides for securing equality of treatment where railway companies work steam-vessels.

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1883. Act passed in reference to railway passenger duty (46 & 47 Vict. cap. 34), providing that—

(1.) Fares not exceeding the rate of one penny per mile shall be exempt from duty.

(2.) Duty shall be payable at the rate of 2 per cent. on fares exceeding the rate of one penny a mile for conveyance between railway stations within one urban district, certified to be so in the manner provided.

(3.) The duty on all other passenger fares to remain at the rate of 5 per cent.

Note.—The railway passenger duty does not extend to Ireland.

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TABULAR APPENDIX.

A.—*Statement showing the Mileage of Railways Open in different Countries at the end of* 1883, *the Total Cost of Construction, and the Average Cost per Mile.*

Countries.	Miles Open.	Total Capital Expenditure (£1 = 1000).	Average Expenditure per Mile.
Germany . .	22,423	£476,168	£21,236
Austria-Hungary .	12,846	316,800	25,266
Belgium [1] . .	2,700	68,522	25,385
Denmark. . .	1,005	7,320	7,283
France . . .	18,725	488,767	27,704
Italy . . .	5,693	111,500	19,585
Luxembourg . .	92	1,781	19,358
Norway . . .	822	5,735	6,976
Holland . . .	1,132	22,213	19,631
Roumania . .	861	16,840	19,558
Russia . . .	14,478	241,021	20,000
Finland . . .	516	2,802	5,430
Switzerland . .	1,673	37,760	22,570
United States [2] .	120,551	1,337,171	11,092
Canada . . .	10,243	125,200	12,223
India . . .	10,832	143,000	13,202
New South Wales .	1,321	16,915	12,810
Cape Colony . .	1,453	13,392	9,217
England . . .	13,215	650,946	49,257
Scotland . . .	2,964	98,531	33,242
Ireland . . .	2,502	35,444	14,106
United Kingdom .	18,681	784,921	42,017

[1] It will be observed that at p. 107 the mileage for Belgium is given as only 1885 miles, but this figure applies to the State railways only.

[2] See footnote to p. 490.

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B.—*Statement showing the Composition of the Total Average Expenditure per Train-Mile on the Principal Railways of the United Kingdom.*

Railways.	Maintenance of Way.	Locomotive Power.	Repairs and Renewals.	Traffic Charges.	Rates, Taxes, &c.	General Charges.	Miscellaneous.	Total per Train-Mile.
	d.	d.	d.	d.	d.	d.	d.	d.
London and N.-Western	6.07	7.86	2.34	12.21	1.88	1.55	0.92	32.83
Midland . . .	4.48	7.67	3.64	9.38	1.50	1.04	0.55	28.26
North-Eastern . .	6.19	10.75	4.35	9.17	1.96	1.12	0.34	33.89
South-Eastern . .	4.97	8.61	2.79	9.80	4.22	2.90	2.00	35.29
Great Eastern . .	4.98	8.56	2.63	10.19	1.93	1.32	1.01	30.62
Great Western . .	6.90	7.69	2.43	8.62	2.23	1.21	0.59	29.67
Great South and West of Ireland .	8.13	9.09	2.95	9.47	2.49	0.84	0.68	33.65
Lancashire and Yorkshire . .	6.23	8.10	3.94	13.21	2.12	1.43	0.50	35.53
London, Brighton, and South Coast .	4.90	8.97	2.48	8.99	3.48	1.28	1.74	31.85
Manchester, Sheffield, and Lincoln .	4.40	7.13	2.81	11.88	1.80	1.86	2.62	32.51
Caledonian . . .	5.04	8.13	3.99	8.50	1.65	1.20	1.62	30.13
Great Northern . .	4.60	7.62	2.46	9.57	1.81	1.39	0.67	28.12

C.—*Statement showing the Average Cost per Mile Open of Railways in the Principal European Countries, &c.*

Years.	United Kingdom.	Germany.	France.	Italy.	Belgium.	Austria-Hungary.	United States.
	£	£	£	£	£	£	£
1872	35,984	...	33,260	19,944	...	21,028	9,938
1873	36,574	19,506	31,900	19,332	...	21,380[1]	11,216
1874	37,078	19,860	32,030	...	23,000	18,840[1]	12,114
1875	37,833	20,066	28,400	19,790	22,952	18,690	12,360
1876	39,012	21,082	27,960	19,745	22,690	18,520	12,090
1877	39,472	21,339	27,590	19,620	23,200	18,658	12,024
1878	40,301	21,157	26,976	19,400	23,320	18,541	11,690
1879	40,518	21,044	27,280	19,714	24,053	18,433	12,027
1880	40,613	21,084	28,450	19,600	24,395	18,500	12,213
1881	41,019	21,165	28,255	19,663	24,435	21,850	12,634
1882	41,605	21,254	27,970	19,856	24,980	21,041	12,772
1883	42,017	21,236	27,700	19,434	25,265	20,897	12,875
1884	42,486	21,100	27,550	...	25,385	20,430	12,792
1885	42,561	...	...	...	...	...	...

* These figures are taken from the "Statistical Abstract of the Principal and other Foreign Countries," but they require some explanation that does not appear on the face of the returns, since the lower average cost per mile in 1884 is *not* accounted for by the lower cost of the railways constructed during the previous twelve months.

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D.—*Statement showing the Numbers of Passengers Carried on the Railways of different Countries*, 1874–84 (1 = 1000).

Years.	United Kingdom.	Prussia.	France.	Austria-Hungary.	Belgium.	Italy.	United States.
1874	477,840	109,570	121,117	41,955	45,164	27,320	190,000
1875	507,975	115,393	131,312	41,348	49,056	27,951	191,000
1876	534,494	116,452	136,987	40,756	51,429	28,076	...
1877	549,541	114,805	138,839	37,856	52,000	28,055	...
1878	565,024	113,792	152,806	38,710	53,502	28,954	...
1879	562,732	114,402	150,525	39,486	53,939	30,405	...
1880	603,885	124,383	165,105	40,455	56,306	32,491	...
1881	626,030	...	179,729	42,818	56,360	34,040	...
1882	654,838	...	194,872	47,211	57,239	34,372	289,030
1883	683,718	167,170	207,171	50,254	61,316	36,817	312,687
1884	694,991	...	...	...	64,460	...	334,571

E.—*Statement showing the Number of Tons of Goods Traffic Carried in different Countries*, 1874–84 (1 = 1000).

Years.	England and Wales.	Prussia.	France.	Austria-Hungary.	United States.	Belgium.	Italy.
1874	160,921	...	...	39,950	200,000	...	...
1875	168,965	89,278	58,932	42,143	202,000	25,620	6,700
1876	173,691	91,354	61,837	45,056	200,000	26,977	7,150
1887	178,871	92,557	61,608	49,271	...	27,017	7,486
1878	175,243	96,841	63,087	50,392	...	28,343	7,507
1879	179,676	105,114	68,987	52,976	...	30,062	8,372
1880	200,392	120,120	80,774	54,354	...	33,198	9,329
1881	209,532	...	86,647	54,634	...	34,549	9,838
1882	217,494	...	88,745	64,754	360,490	36,503	10,473
1883	225,909	...	89,056	70,942	400,453	37,090	11,905
1884	219,974	...	...	...	390,075	35,609	...

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F.—*Statement showing the Statistical Position and Financial Results of American Railways at the end of* 1883.

1. States.	2. Total Line	3. Total Capital[1] (1 = 1000).	4. Cost of Road and Equipment (1 = 1000).	5. Cost of Road and Equipment per Mile (1 = 1000).	6. Gross Earnings (1 = 1000).	7. Net Earnings (1 = 1000).	8. Percentage of Earnings on Cost of Road and Equipment (Col. 4).
New England—	miles.	dols.	dols.	dols.	dols.	dols.	per cent.
Maine	1,161	41,890	41,185	35	4,866	1,377	2
New Hampton	893	27,207	26,952	30	4,162	1,203	4
Vermont	869	41,714	40,132	46	4,523	1,042	3
Massachusetts	2,278	195,624	184,227	80	32,661	8,595	5
Rhode Island	147	6,907	6,260	42	1,490	486	8
Connecticut	974	49,976	47,198	48	11,453	2,401	5
Middle States—							
New York	7,234	830,450	807,965	111	71,694	25,656	3
New Jersey	1,844	235,568	195,454	106	27,390	8,879	5
Pennsylvania	665	823,786	471,900	709	111,842	48,198	10
Delaware	220	11,958	6,434	29	739	194	3
Maryland	1,166	88,784	98,382	84	14,136	6,224	6
West Virginia	400	21,989	17,503	43	922	308	2
Virginia	2,808	196,435	167,855	59	13,984	520	...
North Carolina	1,617	44,414	43,188	26	3,426	873	2
South Carolina	1,592	43,491	41,662	26	5,215	1,501	4
Georgia	2,887	73,929	64,689	22	9,526	2,934	5
Florida	1,063	31,206	26,728	25	1,426	473	2
Alabama	1,892	70,845	63,354	33	7,363	2,228	4
Mississippi	750	43,672	42,092	56	1,213	466	1
Louisiana	1,453	79,270	79,393	54	5,235	2,538	3
Tennessee	2,264	136,524	122,368	54	9,517	3,461	3
Kentucky	2,535	168,516	141,795	55	11,555	4,660	3
W. & S.-W. States, &c.—							
Ohio	9,032	765,983	725,855	80	67,329	22,751	3
Michigan	4,777	193,437	180,202	37	38,118	8,547	5
Indiana	6,454	302,733	278,687	43	36,927	8,590	3
Illinois	12,882	606,870	588,481	45	98,072	41,817	7
Wisconsin	6,297	222,640	221,506	35	27,469	11,014	5
Minnesota	5,273	319,442	307,956	58	25,681	10,020	3
Dakota	237	8,766	8,766	37	...	...	...
Iowa	3,194	116,802	109,055	34	6,317	1,995	2
Nebraska	2,841	208,412	169,256	59	21,648	10,916	5
Kansas	3,734	165,021	161,627	43	21,453	10,029	6
Missouri	6,396	365,285	308,884	48	34,523	15,154	5
Arkansas	1,059	41,328	41,128	38	1,666	563	1
Texas	5,804	242,179	225,471	38	21,459	763	...
Colorado	2,198	97,173	89,305	40	10,888	3,430	4
Wyoming	519	24,962	24,962	48	918	356	1
California	3,375	299,140	295,137	87	28,451	9,284	3
New Mexico	880	89,791	59,401	67	...	...	...
Arizona	384	30,295	...	...	...	...	...
Utah	1,285	40,428	39,973	31	3,836	1,853	5
Nevada	502	27,133	23,794	47	109	19	...
Oregon	1,021	65,608	67,264	65	5,946	2,896	4
Washington T.	37	885	885	23	117	68	8

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G.—*Statement showing the Mileage and Cost of the Principal Railways in England and Wales, Scotland and Ireland, in 1884, with Average Capital Outlay per Mile Open.*

ENGLAND AND WALES.

Railways.	Total Mileage.	Total Capital.	Average Capital per Mile.
Metropolitan	22	£11,331,592	£515,073
Metropolitan District	19	8,365,969	440,314
North London	12	3,895,866	324,655
Neath and Brecon	11	1,590,967	144,633
London, Chatham, and Dover	179	25,182,140	140,682
Manchester, Sheffield, and Lincoln	316	26,192,698	82,888
Lancashire and Yorkshire	496	39,625,014	79,889
South-Eastern	369	21,825,987	59,149
West Lancashire	17	992,797	58,400
London, Brighton, and South Coast	417	23,305,085	55,887
London and North-Western	1,811	99,923,707	55,176
Midland	1,388	74,824,762	53,908
Furness	134	6,719,222	50,143
Potteries, Shrewsbury, and North Wales	28	1,392,464	49,731
Great Northern	785	35,061,843	44,665
Wrexham, Mold, and Connah's Quay	16	701,972	43,873
Northampton and Banbury Junction	15	619,788	41,319
North Staffordshire	193	7,837,552	40,609
Central Wales and Carmarthen Junction	13	494,500	38,038
Great Eastern	1,038	39,691,225	38,238
London and South-Western	722	27,758,237	38,446
North-Eastern	1,534	56,916,314	37,103
Brecon and Merthyr Tydvil Junction	59	1,927,178	32,664
Rhymney	42	1,385,419	32,986
Taff Vale	93	2,884,407	31,015
Great Western	2,301	71,287,997	30,981
Bristol Port, Railway, and Pier	6	166,000	27,666
Isle of Wight	14	370,838	26,488
Somerset and Dorset	91	2,456,209	26,991
Manchester, South Junction, and Altrincham	9	216,666	24,074
Cleator and Workington Junction	21	466,608	22,219
East and West Junction	41	968,588	23,624
Mid-Wales	48	1,104,079	23,002
Cambrian	181	4,277,213	23,631
London, Tilbury, and Southend	49	1,659,382	33,865
Maryport and Carlisle	41	863,600	21,063
Manchester and Milford	41	714,955	17,438
Ryde and Newport	21	225,340	10,730

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Principal Railways in England and Wales, &c., in 1884—(Continued).

Railways.	Total Mileage.	Total Capital.	Average Capital per Mile.
South Wales Mineral	13	£206,960	£15,920
Pembroke and Tenby	29	449,308	15,493
Severn and Wye, and Severn Bridge	37	518,353	14,010
Plymouth and Dartmoor	11	145,144	13,195
Cockermouth, Keswick, and Penrith	32	368,300	11,509
Bury Port and Gwendreath	19	246,070	12,951
Colne Valley and Halstead	19	203,695	10,721
Festiniog	14	148,185	10,584
North Wales (Narrow Gauge)	12	122,488	10,207
Aylesbury and Buckingham	12	119,089	9,924
West Somerset Mineral	12	105,000	8,750
Redruth and Chasewater	10	57,000	5,700
Whitland and Cardigan	14	62,956	4,497
Bodmin and Wadebridge	15	35,500	2,367
Liskeard and Caradon	22	41,825	1,901
Corris	11	19,950	1,814
SCOTLAND.			
Caledonian	878	37,999,000	43,279
Glasgow and South-Western	332	13,230,000	39,849
North British	1,014	32,821,000	32,367
Great North of Scotland	298	4,870,000	16,342
Highland	416	4,445,000	10,685
IRELAND.			
Great Southern and Western	496	7,767,000	15,659
Great Northern	503	6,732,000	13,383
Midland Great Western	425	4,670,000	10,988
Waterford and Limerick	270	2,163,000	8,011
Belfast and Northern Counties	217	1,934,000	8,912

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